

June 4, 1956

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AVIATION WEEK

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PUBLICATION

Martin XP6M-1 SeaMaster



**B-58 Hustler Establishes
Mach 2 Powerplant Pattern**

**Realistic Mockup Helps
Boeing Sell 707 Airliner**



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use. In the American continent
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makes broadest use of this
scope.

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All will share a common tape base.

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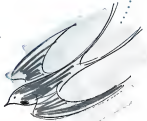
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Sharing in the development of this new breed of supersonic fighters, Holley engineers, working closely with Pratt & Whitney Aircraft on the J-57 engine, designed the compressor bleed governor.

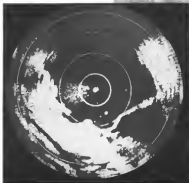
This new Holley compressor bleed governor is one more example of Holley's continuing leadership in the design, development and manufacture of superior engine control systems for both military and civilian use.

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These ground-mapping characteristics are in addition to the recog-

nized superiority of the AVQ-10 as a weather radar. It is the first airborne radar to use the "Chad" (5.6 cm) transmission, the wavelength best suited to weather detection and avoidance, yet having the least amount of scope clutter. With it, the pilot can evaluate storms up to 150 miles ahead and pick up turbulent areas before them. In addition to enabling early detection, the AVQ-10 contributes materially to passenger comfort.

All this has made the demand for the AVQ-10 great and passing. Many leading airlines have already specified it. To secure early installation, other airline and executive plane operators are invited to write now for further information.



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RADIO CORPORATION OF AMERICA
11819 W. Olympic Blvd., Los Angeles, Cal.



Series of indirect weather radar testing done at San Francisco Bay area



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FLY WEATHER-WISE

These weather items prepared in consultation with the United States Weather Bureau

NIGHT FLYING

ON NIGHT FLIGHTS you may have to fly an instrument in case of smoke conditions, due to loss of horizon. It's also hard to judge distance from clouds, and you may find yourself in them. Keep in mind that fog is more common at night than in daytime. And on clear nights over desert areas near mountain ranges, strong Katabatic winds (cool air sliding down mountain slopes) can reach gale strength. This can make it difficult to hold altitude with available power.

However, as a rule, air becomes smoother after sunset, so vertical currents tend to subside. This is especially true in lower levels.



Remember—when it's twilight at 5,000 ft. is already dark on the ground, due to curvature of the earth. Graph shows altitude. You land before dark, determine sunset time and plan flight accordingly.



Watch ground lights at night for signs of fog. This is indicated by lights appearing fuzzy or indistinct.

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Let Ray June 5, 1956



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JUNE 4, 1954

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ANALYTICAL INDEX June 4, 1976

Nike Scores Well in Test 26
► Army's Nike scores seven out of eight hits in test put on during service tour. Only miss a malfunction.

► Stuart G. Tipton, president of Air Transport Association, says CAA investigation unfair for wrong reason.

► **Pan American World Airways** starts first regularly scheduled service New York-Panama service with DC-7C

B-58 Sets Pattern for Mach 2 Powerplant EC
 ► The pattern for one type of powerplant in the next generation of Mach 2 aircraft has been set by Convair's B-58 Hustler.

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The New HAFS-Hield as Hieldmen? ... 3

COVER: Flight tests of XPM-1 Maize ScoMaster are toward eventually promoting in Navy. The 600-hp, wingtip stallprop has been undergoing tests from Champs de Mars airfield. Note its pitch-up speed on page 35 and 99 rather than for mastering forward hydrologic test, wingtip jet engine scoops and tall T-shaped tail. Flaps on both ends of our hull can be used individually, as well as in or brake when needed together.

Picture Credits
 87—Eva Green

45,934 copies of the gene probe

ADDITION WEEK • JUNE 4, 1994 • Vol. 64, No. 21
Member ADP and ABC

B.F. Goodrich

offers six ways to trim weight, reduce costs, improve maintenance



Tubelines to save weight, simplify tire wear handling—B.F. Goodrich Tubeline Tires mean greater payloads—120 pounds for one airline. Save time and money in maintaining by eliminating the tube. The BFG Displayed tread wears slower, more evenly, gives extra life before replacing.



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B.F. Goodrich breaks top National's new 1000-Gi assembly, one long maintenance with more even wear—When full pressure is produced, a full scale "tube" like each brake block evenly around the full circle of the drum. The entire braking surface is utilized.



BFG Shows give Tiger a longer life—Genuine tireless from aircraft wing tanks of F117. Taper with top and bottom aluminum wing sections fastened together by new B.F. Goodrich Seal-Herd Rubber—only one piece blind former with double fluid tube liner in supported for primary structure.



Heated girder gives life-saving bag—B.F. Goodrich's specially heated rubber is one of the most efficient ways of top-loading spot heat. It's light, flexible, has many applications. Here it fits snugly over all ribs to maximize vital flow of lubricating oil deeper low temperatures.



B.F. Goodrich de-lens break the ice faster—Cleveland, Pennsylvania. De-lens on Lockheed Super Constable have smaller tubes, electronic controls, quick easy on, frozen ruts. For more information on tires and rubber products, write: Aero Medical Sales, B.F. Goodrich Tire and Equipment Company, a Division of The B.F. Goodrich Company, Akron, Ohio

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EDITORIAL

The New NATO-Shield or Diaphragm?

The North Atlantic Treaty Organization is being new and important because it is closely related to the past debate now in progress over the future use and technical development of American armor.

Recently we listened to an extremely frank and loud discussion of these new NATO problems by Gen. Leslie M. Brown, new Supreme Allied Forces Commander, and Lord Ismay, representative of NATO in the Palace of Chancellery headquarters in Paris. From this briefing we gathered the following impressions:

• First—NATO is still very much necessary. It would be the sheerest folly to lower the guard in Western Europe solely on the basis of the new Soviet policies. Perhaps the best testimony as to NATO's importance comes from the enemy the Soviets are devoting to their campaign to destroy it.

• Second—NATO still has essentially the same strategic function of providing a dam against further Soviet advances westward but its military tactics to accomplish this goal have changed radically during the past two years. The old NATO tactics called for a heavily armored shield of ground forces utilizing air support to repel any enemy attack as close to the western borders as possible.

Main Reliance Atomic

Now, the main reliance has shifted to atomic firepower delivered by aircraft and missiles. The role of ground forces has shifted from that of a shield to that of a sensitive diaphragm that will record the first enemy attempts at armed aggression. Repeating of this role is the line of NATO ground forces by an enemy would release the trigger which all of the combined atomic firepower of the NATO powers in the same moment that the rupture of the diaphragm in a research gun trigger the generation of hypersonic force.

Although any serious aggression would begin by aerial assault it is still important to maintain this sensitive diaphragm of ground troops because it is tangible evidence of where the frontier has been drawn and it makes necessary use of military force by an enemy bent on further aggression. Without the ground troops it would be easy for an enemy to penetrate further westward in small steps, upsetting local governments and providing "police assistance" to nation order.

General Norstad made it crystal clear that NATO will respond to any enemy aggression with atomic weapons. These include not only the atomic and missile delivery systems now based along an arc stretching from Norway to Turkey but also the strategic bombing force of the Royal Air Force in England, USAF's Strategic Air Force based around the world and the long-range

striking force available from USAF's Tactical Air Command using aerial refueling of atomic weapons carrying fighters. It was made very clear that restoring of the NATO diaphragm will trigger not only NATO forces in Europe but all of the airpower of NATO countries wherever it is based. At the instant this is a retaliation force no nation would dare to challenge. At the present it has the capability of absorbing the most powerful attack that any potential enemy could mount against it and still retain a pulverizing counter-blow.

Other Military Task

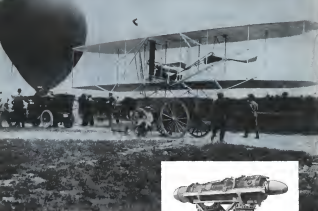
NATO's other current military task is to make the launching of a successful surprise air attack against its military forces. Toward this end NATO has built a new complex of airfields supported by modern logistics, including a fuel pipeline network and air supply. This complex has been built as far behind the radar warning net as possible and it has grown from less than a dozen mobile military fields to more than 300 modern airbases supported by another 300 commercial or military fields. Further target dispersion is provided by the carrier forces of the Sixth Fleet in the Mediterranean, the Royal Air Force in England and the fast-bombing force of SAC.

It is this task of creating a retaliatory force large and fast enough and sufficiently dispersed to make it impossible for any enemy to blast its devastating force by a surprise attack. The bigger the retaliatory force and the more it is dispersed the tougher the problem of wiping it out becomes. This is why the western world needs the Royal Air Force bombers and missiles, the supersonic water-based bombers of the Navy, carrier-based atomic bombers and the long-legged atomic weapons carrying fighters of SAC. Unless an enemy can count on knocking them all out of action in a few hours he will hardly risk the fusion and fission devices they will create in his country.

This is what is at stake when Defense Secretary Charles Wilson's statements that we do not intend to keep up with Russia in long-range bomber production, as White House associates that intermediate-range ballistic missiles are not really significant, in the conclusions of the House Appropriations Armed Services Subcommittee that the Eisenhower Administration has given up the traditional American policy of maintaining air superiority and is settling for a second best support "just big enough" to keep a possible enemy wary.

Unless U. S. policy is fixed firmly to the concept of maintaining superior support in developing new aerial weapons faster than any potential enemy the entire defense effort beginning with NATO will collapse like a house of cards.

—Robert Holt



...“the flying machine must be designed to be carried in an Army wagon.”

U. S. Army specifications, 1908

Aircraft ground support equipment has come a long way in 68 years. The *Air Log System*—one unit of which, the Model 400A portable trailer, is shown in inset—is an example of system engineering required to meet the existing demands of the Armed Services 50 years from now at this jet age. The research, engineering, and manufacturing facilities of *Air Logistics* are dedicated to furthering that readiness by designing and producing a complete system of ground support equipment today that will meet tomorrow's demands of both military and civilian aviation.

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WHO'S WHERE

In the Front Office

Vol. L. Fells, vice, personnel production, Goodrich Aircraft Corp., Akron, Ohio.
Cam C. Mabel, executive vice president general manager, Fairbanks Corp., Los Angeles, Calif.

J. Woodrow Thomas, vice president, Trans World Airlines, Inc.
C. K. McLeod, president, Walter Kidde & Company of Canada Ltd.

James O. McElwain, president, new, General Control, Inc., Cambridge, Mass.
Vernon W. Herbert, E. Gorman, vice president/engineering, Richard W. Lawrence, vice president sales, Robert H. Genger, vice president finance, and Charles M. Ganser, vice president, Bell.

Charles M. Jelske, vice president, Thurston Co., Portland, N. J.
Col. Earl W. Hailst (USA, ret.) assistant to the president, Borg-Warner Aerospace Corp., Chicago, Ill.

Dr. Lloyd R. Ziesenheim and Dr. Charles D. Conwell, directors, Machine Tool and Engineering Corp., Pittsburgh, Pa.

Earl M. Haskany, vice president, Aero, three Flying Service, Middleburg, Ga. Also, John M. Haskany (vice president) assistant manager of Charlotte headquarters and field line operations.

Honors and Elections

William F. Bowers, assistant to the chief executive officer of the National Aeronautics Association, has received the first public relations award of the Aviation Division Association for his contribution toward a better public understanding of research problems through consistent and simplified dissemination of highly technical information.

Changes

Arthur T. Gorman, commercial vice president and A. Elliott Merrill, sales manager, Bowers, Appleton Co., Seattle, Wash. Also, D. R. "Red" Merkle, sales manager, Seattle Division, Kennick, C. O. Also, special transport division sales: Blaine Ott, transport division sales; (Glenora, Wash.) and Robert J. Mosley, assistant to director of sales.

George E. Feltner, public relations director, Knight General Corp., Ames, Calif. He succeeds William H. Falk, who is now producing a series of public service data system that is being for the Defense Department.

Arnold E. Hart, general manager, new, Clifton Promotional Products Co., Inc., Clifton, New Jersey, Pa.

Cordell D. Davis, U. S. operations manager (Hawaii) Special, Pacific Air Lines of Japan.

George Magnuson, chief mechanical engineer, Northrup Aircraft, Inc., Hawthorne, Calif. He succeeds F. J. Perkins, assistant chief engineer. Don D. Wines, chief mechanical and Jack Monahan, assistant to vice president and general manager.

George L. Eagle, sales training director, Mohr's Aircraft.

INDUSTRY OBSERVER

Must powerful ground radar ever built in the U. S., will undergo Air Force tests at Lowry, Tex., possibly to evaluate its ability to detect and track ballistic missiles fired at the White Sands, N. M. Proving Ground 900 mi. away. Another possibility is that the multi-segment radar, mounted atop a 100 ft. tower is being evaluated for its ability to detect infrared emissions in the Gulf of Mexico to make an effect a southern DEW line.

North American Aviation, Inc., has flown 35 test vehicles of its SM-64 Navaho experimental vehicle. Twenty of the vehicles, all of them equipped with landing gear, were recovered.

Flap structures on the Boeing B-52 have been strengthened to withstand sonic vibration from the right F-4 & Whites (F-4) tailgun engines during water injection. In some instances, the vibration had caused flap cracks to develop in the structure.

Parts for the first Crossbow subsonic air-to-ground missile are now being assembled by Rockwell, Inc. The vehicle should be test flown within the next month.

Air Force hopes to test an airborne target through Mach 1 by early summer. Tests up to Mach 3 have been made thus far.

A rocket sled truck being built at USAF's Armstrong Center, Eglin AFB, Fla., is designed to provide velocities up to Mach 3 for evaluation of weapon effectiveness. Controlled impact can be obtained at velocities exceeding the speed of an aircraft plus the speed of the weapon, without the weapon being fired.

Experiments are underway on freighter versions of the Borch Dart towed target (AW May 7, p. 51) that distinguishes when hit by gunfire, giving pilots the feel of a "ball." New models are made of paper, aluminum, plastic, and other light materials. Stowable Darts are made of plywood and metal tubing.

Arms is equipping a number of Borch L-23 Twin Beutons with radar receivers to allow evaluation of low level receiver of Nite assets under radar coverage.

Lockheed's Mach 2 F104A Starfighter is equipped with an air conditioning system, pneumatic system and fuel control designed and manufactured by Hamilton Standard Division of United Aircraft Corp.

Roll out of Canadian's CL-35, maritime reconnaissance version of the Beuton Beutons transport, is scheduled for sometime towards the end of the year. A total of 25 of the aircraft have been ordered thus far.

Approximately 600 B-52 of Douglas will be used in the Boeing 707 jet transport between the main and water landing shifts in the division's main line. Douglas's main line Douglas ships will be used where the carrier shift is connected to the Douglas lines.

U. S. Army is studying Navy's shipboard cargo loading system for possible application on aircraft carrier. Forward-cargo loading system. The idea originates not borrowed from the British Navy.

The cost of into take-off units for the B-47 bomber has been reduced from about \$400 to \$160 per unit. A full-sized, retractable B-47 requires about 30 units—costing a total \$4,800—for a takeoff.

Douglas Aircraft apparently has had to lower its DC-8 guaranteed maximum Mach number at high altitudes because of cut back safety factor requirements. The Douglas jet transport wing uses three different Douglas developed airfoil sections.



AMHIAH When long-range bombers, superimposed on picture of Pacer down taken in instant of Nike warhead detection shows relative miss compared to lethal radius of blast. Seen also help explain why a tiny down might escape destruction by fragments that would kill a large bomber. Photos were taken from Arkansas photo threshold tracking instrument. Pacer was above 35,000 ft, and ending 190 lbs. when the intercept occurred.

Army's Nike Scores Seven for Eight

One miss a malfunction causing fail-safe air burst over launching site. Test made during service row.

By David A. Anderson

White Sands Proving Ground, N. M.—A final scoring of eight Nike rounds fired last during a two-day, green team gave the Army's anti-aircraft missile seven successful strikes on eight bombs launched. There was a single causal malfunction that caused a fail safe air burst above the launching site.

The Army scoring is now for rating Nike batteries does not count the malfunction against the firing battery. This procedure gave a widely reported impression that the Army often was for 100% hits.

Turning of the Proving Ground test coincides with the Army's first row over the relative capabilities of the Nike and Talos, a Navy-developed shipboard anti-aircraft missile which

USAF needs for defense of SAC bases in the United States. The scoring will look at if Army now firing the rounds to reduce USAF's claim of Nike inferiority.

Not Comparable

But Nike and Talos are not directly comparable, and "comparative" tests could not prove anything. Nike is the older weapon and has been operational since December 1955. Talos is still in the developmental firing stage although it is in production under a December prime contract. Nike was placed on an inner zone defense to take over after long-range interceptors and missile attacks had whittled down the aggressor air strike.

There is an argument on the limited range of Nike. Largest intercept by

the service was at a short range of just under 25 mi. about at the point where a bomber with B-52 performance would be releasing its bombs. Talos range is about twice that of Nike.

Firing at Targets

Six of the rounds were fired against Reduphine QG 19 target drones at altitudes under 15,000 ft above the local terrain and speeds of about 150 mph. The other two, fired as part of an Army program to determine Nike capability against a small jet-propelled target drone, were launched against the Ryan QG 2 Pacer traveling at 500 kts at about 16,000 ft above terrain.

Even after of firing plus other data on the overall scores obtained during the normal practice firings at Red Canyon indicated the Nike is highly reliable as an operational weapon. Most USAF squadron commanders would be delighted with a 95% probability of combat success of all times that figure



NIKE second fired during green team of White Sands Proving Ground was up to intercept jet-propelled Pacer drone.

being approached closely by the Nike missile.

The significance of that percentage takes on greater value considering the size of the Nike rounds fired during practice. The standard procedure is to take the Nikes that have been on one-on-one storage longest to Red Canyon. Some of the birds fired there are as much as three years old. That is a considerable risk to taking a fighter out of three-year storage and finding it to be unable to fight with all the electronic gear working. All systems operating and the gun able to fire.

Warhead Effects

Nike's warhead is a fragmentation type, detonated at a computed location in space by an automatic system from the ground link. Location of the burst is calculated to produce maximum lethal effect. Consequently, it is below and ahead of the target. The detonation of the warhead at speeds of a large area of fragments over the air and the target flies on a collision course into the spread.

Such a warhead blast does not need to destroy a target drone in order to act as a successful strike. The defense believes individual fragments are large enough to let a drone flip be scattered somewhere. But a half-mile amplitude, many times the drone's dimensions, could be destroyed by the shock. The slip stream would do the rest, leaving



ARMY BIG THREE Heavy jobs, Nike and Corporal missiles shown on their field action launching units.

off the panel dust punctured by the fragments.

Drone Targets

Criticism of Nike's performance has also centered around the characteristics of the drone being used as targets. Pacer possesses the Reduphine QG 15 have a top speed of about 150 mph and a maximum climb capability of 25,000 ft although most of the strikes witnessed were under 15,000 ft above the terrain.

The birds are fast better targets are not available cheaply and in quantity.

The QG-15 cost about \$1,000 apiece, even though more than 40,000 have been made. The Pacer costs many times that. Drone B-4's is comparable hardware are out of the question.

To simulate more high-performance targets, the Army has resorted to firing against manned aircraft with a 1,500 and about 60 degree offset on the tracking radar. In testing in this field area, they can track a B-45 target plane, fire to a computed point in space and simulate an actual hit on the B-45. Nike also have been targeted against USAF Mustangs, using a fixed miss dis-



RED CANYON Range Camp is site for annual field firing practice for Nike defense batteries stationed throughout the United States.

three air into the radar to avoid destroying that expensive target.

So, said the Army, gets a different kind of a target, said Nike missiles will assist in the accuracy of the radar tracking system rather than in the actual ability to kill an enemy. This radar accuracy is linked by the Air Force, says to launch Nike radar at initial centers of the Air Research and Development Command where precise location of enemy and missiles in space is vital to the test program.

"We know the Nike can destroy a bomber if it bursts in the proper location," said one Army official. "We also know it can destroy a jet in a man of a jet but has a very good shot. We don't have to test before we move to find that out. Our problem is the cost for both. We have to train the men who acquire the weapon."

Filings and Scams

Three different levels of Nike filings were witnessed.

Two research and development projects were filed at the White Sands Proving Ground. Those launches were set up for this year, but the batteries were from the Proving Ground's standard mission, and the third was a field test. Round 4 battery (AW May 24, p. 28).

Two training rounds were fired at Red Cross Range Camp by Able and Baker batteries of the 44th Nike Force Training Unit. The unit is in the 96th Air Assault Missile Battalion which has been stationed near Bangle, Conn., and was converting from Vietnam guns to Nike.

Two actual practice rounds were fired at Red Cross Range Camp by Able and Baker batteries of the 51st Air-Aircraft Missile Battalion, usually assigned at Nike sites on Benning Range, Fla. Project Scramble, the 51st's aerial gun practice at Red Cross, was a result of 11 hits for 12 Nike rounds fired.

Nike Air Force

Round 1, round 2, this is the way the Nike Army was trained.

Round 1, research and development being against a strike down. The down was dropped from a USAF-operated B-26 bomber plane at 21,000 ft altitude above the launching area, and directed in a climbing flight path to 20,000 ft of altitude. The Nike missile. The down was then turned and began a high-speed run toward the missile launcher. The Nike then shot at the down and the down (see picture), and under the heat the missile and target.

The receiver chaser deployed and the missile target was recovered. Said the Army. "The strike would have

destroyed an aircraft. . . ." Scam, and successful strike.

Round 2, research and development being against a F-4 bomber. This second round was fired at the same target as the first round, and was launched before the first round hit. The Nike exploded on the predicted flight path of the target. Scam one successful strike.

Round 3, training round fired by Able Battery 96th AAM Bn, against an OQ-19 RCAT drone. This was the first Nike fired by the battery, the best deviation from the predicted spot was also in two of the three dimensions that could be seen on the recorder scope as the Nike went. Flight data to report was 101 miles, the target was hit at an altitude of about 10,000 ft above the terrain and a distance of 45,000 yd (about 25 mi) short target. Scam one successful round.

Round 4, training round fired by Baker Battery, 96th AAM Bn against an OQ-19 RCAT drone. This was the battery's first live round, best deviation was again seen and the BACAT was launched on the correct flight time to impact was 81 sec, the drone was at 10,000 ft above the terrain and at a distance of 42,000 yd (about 24 mi). Scam one successful round.

Round 5, practice round fired by Charlie Battery, 51st AAM Bn against an OQ-19 drone. The Nike was a successful shot, the target was within the expected distance left distance, but

the drone was not destroyed. Scam one successful round.

Round 6, practice round fired by Charlie Battery, 51st AAM Bn against an OQ-19 drone. The Nike launching phase was successful, but at least at separation of the target, there was a misalignment in the missile. It failed to hit by blowing up its warhead over the booster disposal area. Scam unsuccessful round due to missile malfunction.

Round 7, practice round fired by Able Battery, 51st AAM Bn against an OQ-19 drone. Nike made the intercept at 40,000 yd, range (about 23 mi) and 10,000 ft above the terrain. The warhead burst on the target 130 yd above the terrain, and it then began to lose altitude rapidly. The parachute deployed for recovery. Scam one successful round.

Round 8, practice round fired by Able Battery, 51st AAM Bn against the same OQ-19 drone that was the target for the seventh round. This round was launched before the seventh hit, but after the seventh Nike had destroyed the target, the eighth began to track on the parachute and hit burst destroyed the target at 16,000 ft above the terrain and a range of 41,000 yd (about 23 mi). Scam one successful round.

Round nine for the eight rounds fired was seven hits and one misalignment not changed against the same.

ICBM Re-Entry Is Simulated

By Irving Stone

Moffett Field, Calif.—The entry of the intercontinental ballistic missile into the earth's atmosphere is being simulated with a new hydrogen gas and acetylene gas system at the Air Force's National Aerospace Laboratories of the National Aeronautics and Space Administration (NASA).

The speeds and temperatures which a full scale missile would encounter in flight are being duplicated using this equipment. The gas propels a model at 10,000 mph. A mass pressure, self-heating gas, now being developed, would speed the speed to about 15,000 mph.

According to Dr. A. C. Charlton, research director scientific at Ames, the new experimental equipment will permit the study of the various phases of flight such as heating, thermal stress, surface combustion etc. it will allow the entry flight to be reproduced in a single test. In this way, he says, the various phases of the flight through re-entry can be explored and solutions sought to the various problems encountered.

Laboratory flight tests with the light

gas gun are very successful with respect to the appearance of re-entry in the atmosphere to the appearance of large-scale flight tests, he points out.

The principle of operation of the hydrogen gas gun consisted of the New Model 1000, which is a gas gun developed in the late 1940s. This gas gun used hydrogen as the gas medium. The Ames gas gun is a hydrogen gas gun.

Pumped to Pressure

The helium is introduced into the chamber of the gas at low pressure and then pumped to very high pressure in a single rapid stroke, being heated by the energy of the stroke. The gas is then released into the chamber. The model is held by a mechanical device until the desired pressure is reached, depending on the launch velocity required. The gas is released and the model is then released into the chamber. The model is then released into the chamber.

A typical shot consists of a model and a shot. The shot is fired through the gas gun and the shot is fired through the gas gun. The shot is fired through the gas gun and the shot is fired through the gas gun.

A model strikes into the gas so fast

Atlas Site Shifted

San Diego—Moving to new place, Cassini will move the site of the planned 54-million dollar missile plant (AW May 7, p. 34) from the vicinity of the Missouri Naval Air Station to an alternate site in the area. The Navy had complained that the facility at its originally proposed site near La Jolla would interfere with operations out of Miramar.

The change in place will shift the plant to property located near Miramar. The plant is a point approximately eight miles from the center of San Diego and will be completed, originally scheduled for late 1965, between mid and early next year. The plant will employ 40,000 persons when it goes into full operation in the research, development and production of the intercontinental ballistic missile.

It can be photographed by its own infrared radiation.

One model employed at Ames is a 4-in. diameter sphere so constructed that it will undergo the same aerodynamic heating as the full scale vehicle. It is being planned for the International Geophysical Year.

Track Launch

The model is launched into a long tube. The tube is composed of the air in the tube can be changed to correspond to flight conditions at various points along a country trajectory at a specific flight path. In this way, the model can be launched into the air in the tube can be changed to correspond to flight conditions at various points along a country trajectory at a specific flight path.

In another setup, Charlton reveals, the track would be replaced by a supersonic wind tunnel having a long working section.

The model would be launched along the axis of the tunnel against the direction of the wind stream and its flight would be recorded as it entered the working section.

In this way, Charlton says, it is possible to track extremely high Mach numbers. The present flight gas gun used in the supersonic flow tunnel at Ames will give a flight Mach number of 20.

The light gas gun now under design, said in the new tunnel, will give a Mach number greater than 10. This gun would be capable of launching a 1-in. diameter missile model.

Models have been recovered after flight. Recovery is accomplished by having the model pass through a section of the tunnel with a section of the tunnel and then into ordinary water's down.

Telemetry equipment is being designed for use in this small model

Dummy Explodes in Ejection From F-84 at Supersonic Speed

Hampton, Va.—The anticipated pilot ejection in an F-84 was simulated at a sea level speed of Mach 1.32 (nearly 1,000 mph) when he hit his last but not the supersonic wind tunnel. That result is coming from a test run April 27 at Project Smead, supersonic military air research track here.

What will happen to him at speeds up to Mach 2 will be investigated next, as will be the equipment assigned to the pilot. The test is a continuation of the "ejector" approach and Republic's capsule for pilot survival. Both are slated for testing here soon.

Project Smead was built for USAF's Wright Air Development Command, which makes overall general decisions for testing. Prime contractor for design, construction and operation of Smead is Calhoun Engineering Co., Chester, Ohio, which has been working on the design and construction. The first run on the track was made last July 8, and since 14 has been accomplished since, from low subsonic speeds to Mach 1.4 at the 1,000 ft altitude level. The test is being conducted by the Ames Research Center, Moffett Field, Calif.

The original contract specifies that velocities producing aerodynamic pressure equivalent to sea level Mach 2.5 be achieved by the model. The model will be tested at sea level Mach 2.5, with overall velocity 30 mph more than the actual Mach number.

Build A Step Model

Smead is built on a horizontal track, which ends in a bank with north-south sides down to the level of the Virginia River, 1,100 ft below. The track ends at the bank, the bank is made of concrete and is 1,100 ft long. The track is made of concrete and is 1,100 ft long. The track is made of concrete and is 1,100 ft long.

Each of the track's ribs is a single welded length. Ribs were set in tension to reduce or increase the aerodynamic effect upon the track's dimensions, which are held to extremely close tolerances, within 1/10,000 in. in production. The track is made of concrete and is 1,100 ft long. The track is made of concrete and is 1,100 ft long.

The overall test consists of the track, a control system, an administration building, gun building, crane and other facilities. The test is being conducted by the Ames Research Center, Moffett Field, Calif. The test is being conducted by the Ames Research Center, Moffett Field, Calif.

point is the test. The test is being conducted by the Ames Research Center, Moffett Field, Calif. The test is being conducted by the Ames Research Center, Moffett Field, Calif.

Solid Propellant

The solid propellant weighs from 450 to 600 lb gross weight, depending on the instrumentation of the test and the equipment being tested. The solid propellant is made of solid propellant. The solid propellant is made of solid propellant.

The Smead project is a research tool for advancing the state of the art in supersonic flight. The test is being conducted by the Ames Research Center, Moffett Field, Calif. The test is being conducted by the Ames Research Center, Moffett Field, Calif.

ATA President Tipton Criticizes CAB Airline Fare Investigation

San Francisco—The Civil Aeronautics Board was charged by the Air Transport Association last week with steering its investigation of general airline fares in the wrong way.

The Board gave an alleged high level of airline prices in the review for its concern, Stuart G. Tipton, president of ATA, told the Aviation Writers Association.

Asserting that the CAB did not answer airline fare high, Tipton denied the aim by the Board of the review on an investigation in the formula for determining profitable profit.

"Hark! the Board must look up to the cost question. This much money do the airlines need to do this job? His Board must answer that," Tipton said, "and then be prepared to support and defend the industry in getting that much money."

Tipton said coming from all sources for the last five years were about \$1,500,000,000, Tipton said. Of this figure 83% or \$1,000,000,000 was ploughed back into new and better equipment. Only 18% or about \$200 million was paid out in dividends, Tipton said, and "a large portion of these dividends was paid to preferred stockholders. Virtually none went to a credit stock plan."

Tipton cited three other facts:

- Airlines dividend are not amounted to 32% of net profits after taxes, compared with 47% for all U.S. corporations.

F5D Exceeds Mach 1 In First Flight

San Francisco—The Navy's Douglas F5D Skyhawk exceeded the speed of sound in its first flight records at Edwards AFB.

Wing phenomena, general appearance and arrangement as the same as the F5D. Equipped with the Pratt & Whitney F57 engine, the F5D has been designed for greater speed, range, and endurance. The Skyhawk will be a multi-purpose fast airplane, serving either as a fighter or all weather interceptor.

F5D stretch will begin coming off the Douglas B-2 Superfortress production line in about next month. Production is expected to be supported in part by transfer of funds from the F1D program.

- Although a growth industry, airline capacity has increased only 35% since 1946. Other growth industries have shown spectacular price increases: automobiles, aircraft manufacturing 542% and aluminum 475%.

- Air fares today are just about level with those of 1948, despite cost increases including a 215% increase in airline wages and an over 50% increase in corporate prices.

Missile, Satellite Products Useful

By **Alphina W. Joseph**

Midfield Field—Civil aviation and defense will receive major benefits in the years to come from the by-products of missile and satellite technology, said L. Hibbard, vice president and general manager of the Lockheed Aircraft Corp. in a speech before the Aviation Writers Association.

Hibbard predicted that the wing of the F-104 Starfighter could soon develop again, enlarged in scale to the wing of a supersonic commercial transport. The F-104 wing he said, "once thought from a single use being being for your time." Another benefit to civil aviation, Hibbard said, is the techniques and equipment to handle the shockwaves and air flow patterns when the air will be full of jet trails, created using plagues, balloons, de-icers, and so on.

In the process of looking at the advanced data and guidance systems and data control and reduction systems for missiles, they (the shock waves) are solving the problems and building the equipment to control this area in the track of the future."

He also predicted that rail and freight vessels will be on no other than the U.S. and on world routes.

Hibbard linked general applications of satellites in:

- Navigation. Most celestial reference points with lightest satellites to ride could be positioned where they are wanted. Thus automatic plotting of ground and measured vehicles with unprecedented precision would be possible.

- Communication. Properly placed satellites could reflect on broadcast signals far from line of sight locations.
- Meteorology and Climatology. Satellites put up where they can observe the whole panoramic view of the weather

as it forms and moves will enable the weathermen to make absolutely dependable forecasts. Eventually we may have enough air space to use only plasmaspheres, magnetic shields, and magnetic ducts to forecast long range weather cycles and "maybe even do something about them."

Hibbard stressed the direct uses of missile and satellite remote technology would be the purpose of the weight problem will lead to new electronic equipment that will be cheaper, smaller and better. The applications will be made to mass inspection, design-watches, product selection aids, instant communications to anywhere and about machines to handle tomorrow.

Hibbard predicted that the remote control of an aircraft will be of cheap and mass use. With their problems simplified by having an antenna above the clouds, they may perfect their effective applications of nuclear, solar and laser energy into the sky — close to head in conventional aircraft."

Plant Mills Steel, Titanium Chemically

Los Angeles—The first pilot plant for the chemical refining of steel and titanium in an open-hearth furnace, using air gases, for the North American SM-64 Nucleon intercontinental guided missile.

The plant, located at the facilities of Union Carbide, Inc., is being operated by the major research and development effort with North American Aviation, successor of the potential Glenn Mill process.

A preliminary test for chemical refining of steel and titanium, which requires 200 parts per unit, will begin operation at North American's Downey plant in September.

• When the authors try new equipment, they contribute them to the civil service as that, such as to be called on government service in emergencies.

"This means you continue to have the greatest relief action in the world if only you government employees, the great public men with which it is dealing, recognize the duties that can come from them, the national benefits that can flow from social policy," Tipton declared.

The condition forecast an aggressive campaign by ATA. "Perhaps it is high time that the airlines came at the CAB with the powerful arguments which must convince the Board of the special needs of an transportation system and give the Board an opportunity to remove its gross responsibilities."

as it forms and moves will enable the weathermen to make absolutely dependable forecasts. Eventually we may have enough air space to use only plasmaspheres, magnetic shields, and magnetic ducts to forecast long range weather cycles and "maybe even do something about them."

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DC-8 Climb, Cruise, Fuel Use, Speed Is Described by United

San Francisco—Operational characteristics of the Douglas DC-8 which United has been using extensively in the fall of 1959 were presented for Aviation Writers Assn. United will be the first to operate this jet transport.

W. E. Shelden, UAL, manager of their engineering, said:

- DC-8 climb will be somewhat conventional, except faster than usual in updraft programs.
- Initial rate of climb will be very much like today's planes with the DC-8 climb rate to 200 ft. at last rate of climb speed. From this point, rate of climb will be 2,000 ft. or higher, depending on the load. Low-altitude turbulence will be minimal in about 200 ft. or less.

- Plane will climb 30,000 ft. in 15 to 17 min. The heavy, long-range version probably will level off between 25,000 and 30,000 ft. for first stage cruise and, after some fuel is burned in between the load, the plane will climb to 35,000 ft. for final stage cruise.

- Climb to 30,000 ft. altitude will require about 1,200 gal. of fuel. Average fuel consumption rate will be about 2,200 gal. per hour.
- At 30,000 ft., the flight would be above most of the weather, except thunderstorms. Very few large thunderstorms would be encountered, and no bad weather.

- Better methods will have to be evolved to deal with storms when the plane is reaching terminal, and to avoid them when being enroute.

- Actual flight time San Francisco to New York, will be about 4 to 4½ hrs. plus about 15 min. for ground time. Westbound flight time will be about 5 to 5½ hrs. with 15 min. more for ground time.
- Time will be presented from no

level up to about 23,000 ft. This will be an operational necessity in order to get maximum descent comfortably, since several jobs of descent of the DC-8 may be from 4,000 to 5,000 ft. per hour.

- Descent for approach landing will be made from cruising altitude in 7 or 8 min.
- Passengers would have pleasant view, unobstructed from most seats.

Russian Researcher's

Pay Cut by 50%

The high pay scale for Russian scientists and teachers in higher educational establishments has been cut by 50%.

The action was taken for two main reasons to channel some of the non-productive research into productive industrial jobs, and to appeal for more support from the industrial and manufacturing side now being exerted by the present regime in Russia.

First meetings against members in the wage question were held at a conference of industrial managers last summer. The 20th Party Congress and further criticism of the plan had been published in Komsomol'skaya Pravda as an official decree.

Major complaint of the newspaper article seems to be that some Red researchers are living on the degree and the salary they established some time ago, rather than continuing to be producers of scientific thought.

Under the old system, a researcher achieved his advanced degree after his dissertation, and almost immediately became one of the scientific elite with salary package two or three times as much as in industrial plant manager.

Originally, Pavlov's list of directors specified that five salaries for 40 are not to be in hand before large scale production testing could begin. This has recently been modified, and will now be contracted for without the necessary order change.

Two months remain before the production testing begins has to be made. By that time, Pavlov's experts will have been contracted for without the necessary order change.

First, essential transport side is about to be announced. One competition has already received approval from its board of directors to make a flight of the airplane. Another, a Soviet Union, has verbally committed itself to a small French order.

Twinning to Visit USSR

Washington—Gen. Nathan F. Twining, USAF Chief of Staff, last week accepted Kozlov's invitation to attend the Soviet Air Force exhibition in Moscow on June 24.

The announcement of Gen. Twining's acceptance, made upon the personal direction of President Eisenhower, and he will be accompanied by the Deputy "General Air Force officers." The delay, the announcement had been a reply in the hope that the invitation would be extended to include other members of the Joint Chiefs. Such an invitation, however, apparently was not forthcoming.

In fact, Russia is probably the only country in the world where a college professor or researcher is at the top of the wage-makers list.

The cost of getting by the single lowest of salaries in a profession of a very low level of low productivity and high salary has been recognized by young Soviet students who have aimed at degrading.

The article often says that the Soviet economy is a danger among young scientists. "A degree is power." "What is important is not knowledge, but a degree." "On to degrees."

Bonanza Orders

Fairchild F-27

San Francisco—American Airlines became the third operator to order the Fairchild F-27 turboprop airplane last week. Its order is the first Fairchild order since the first order to 17.

An option for an additional three aircraft was also ordered.

Working at Fairchild's Hagerman plant has just been visited and the first order will be in about next month. First flight of an American-built model of the F-27 is scheduled for about next month. It will be made by the Fairchild plant in Hagerman, Idaho.

Originally, Pavlov's list of directors specified that five salaries for 40 are not to be in hand before large scale production testing could begin. This has recently been modified, and will now be contracted for without the necessary order change.

Two months remain before the production testing begins has to be made. By that time, Pavlov's experts will have been contracted for without the necessary order change.

First, essential transport side is about to be announced. One competition has already received approval from its board of directors to make a flight of the airplane. Another, a Soviet Union, has verbally committed itself to a small French order.

Army Outlines Aviation Program, Sees No Conflict With USAF

By Evert Clark

Washington—Army Aviation's tough-to-pleased-to-in budget presentation to Congress and a recently-released outline of its five-year plan to combine the Joint Chiefs of Staff, the Air Force, Congress and the public that it can continue to grow without antagonizing on Air Force objections.

The Army presented its five-year plan to the Joint Chiefs last week—likely in an attempt to make it clear that the Army's program on the air is not competitive with that of any other service, according to Maj. Gen. Harshbarger H. Howe, director of Army Aviation. The Joint Chiefs still have it under study.

Gen. Howe said the Army has not yet asked for any change in the 1953 Memorandum of Understanding—which limits the size of fixed-wing Army aircraft to 5,000 lb., empty weight—and will not ask for any in the near future.

Other Army spokesmen indicated no change will be asked for until some additional research and development program produces an aircraft suitable for Army use and over the weight limit. Then, with a specific aircraft to talk about, Army would make its request with a plausible expectation of success.

Although that probably will not come in the near future, it is quite likely to come before the end of the year.

So far the public has seen only the five-year plan, although Gen. Howe looked at least one congressional committee recently. Most of his comments on details of the plan were off the record.

The Army has released its "Army Aviation Fact Sheet" which it says describes the broad general outline of the five-year plan. The fact sheet contains little detail.

It generally bears out Gen. Howe's statement in an interview that the five-year plan "is merely a methodical outline for our own development along present lines, and not a departure from previous concepts"—an attempt to move into Air Force territory.

It mentions the Army's interest in a future, short-takeoff observation plane, but describes it in far less detail than Gen. Howe described it to Congress (AWW May 14, p. 31). Development contracts will be let for this plane by the Navy in some six months or so, and between that Army and the Marine Corps, which also has a requirement for it. Army and Marine have agreed on almost all points but Army favors

broken testing, with "one head above the other" for better visibility, and Marines favor side-by-side.

The fact sheet also notes that the Army has "under study" a possible requirement for "a relatively small fixed-wing transport aircraft (5 to 5 tons payload)" to "increase significantly the mobility of ground troops, not only in the air but in the area of contact with the enemy."

Although the fact sheet says the Army "may" have this requirement in the future, it also notes that "considerably greater dependence" must ultimately be placed on the fixed-wing cargo aircraft such as those mentioned above "for moving troops from the place where Air Force transports leave them to 'small units of the field army.'"

Gen. Howe admits that the Army program is "limited, somewhat, and modest" and says he is convinced that most Air Force objections to the Army's aviation plans come from "a misunderstanding."

He says the new observation plane is "not in any way an attempt to conflict with Air Force tactical reconnaissance," the Army's desire for "unconditional command" of its aircraft

during combat can be worked out by agreement with Air Force and advance work in electronic technology (for example, the use of transponders) and improved tactical air traffic control, and that he would leave "all long-range troop movement" to the Air Force.

What the Army objects to and would like to get rid of are "substantive limitations"—generally in pounds and miles—which keep the Army from performing missions which consequently are assigned to it, he said.

Mach 1.2 Bomb Drop Confirmed by Navy

Washington—The Navy and last week that a naval aircraft in level flight has successfully released a bomb at a speed of Mach 1.2, exceeding an Aviation Week report of Feb. 13 (p. 25). This is the highest speed ever recorded for such a drop.

The drop was accomplished with a small, lightweight explosive bolt developed by the Motion Picture Camera Co. of Philadelphia for the Bureau of Aeronautics. The device, noted at the Naval Air Test Center, Patuxent, Md., enables the bomb to make a routine trajectory, determining the tendency to collision with the aircraft in unpropelled release.

The bolt is set in ball by a self-contained powder charge.

Military Aviation Funds

The three military services had an unexpended balance on hand, as of Aug. 1, of over \$50 billion for aircraft, guided missiles and electronic equipment. Following are details reported by the Department of Defense (DOO summary)

	OBLIGATIONS		EXPENDITURES	
	July 1, 1955 to Aug. 1, 1956	Unexpended Balance, Aug. 1	July 1, 1955 to Aug. 1, 1956	Unexpended Balance, Aug. 1
Aircraft and Engines				
Air Force	\$8,746,324	\$6,955,151	\$5,796,315	\$11,395,190
Navy	5,173,218	2,530,116	1,085,176	4,902,482
Army	15,105	117,571	70,891	285,645
TOTAL	13,934,647	9,602,838	6,852,382	16,583,317
Guided Missiles				
Air Force	605,356	530,348	404,873	1,331,441
Navy	553,459	191,349	131,591	420,548
Army	873,817	169,577	389,681	819,011
TOTAL	1,032,632	891,274	926,145	2,571,000
Electronic & Communications Equipment				
Air Force	558,006	769,061	384,199	1,289,337
Navy	66,351	113,941	49,132	399,887
Army	76,195	87,149	104,444	484,259
TOTAL	690,552	970,151	537,775	2,173,483



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U.S. Tries to Boost Confidence In NATO at European Air Show

By Claude Winsa

Zurich—Against disconcerting odds and an obvious Soviet effort to put its Pacific foot forward, the U.S. Air Force and Army displayed their aircraft and aerial might at the two-day Intercontinental Air Show here in an effort to bolster waning European confidence in the power of the North Atlantic Treaty Organization.

While European newspapers went gung-ho publicly to statements outlining U.S. weaknesses by Gen. Curtis E. LeMay, Strategic Air Command commander, and Gen. Erik E. Felt, Jr., Air Force chief of staff, the U.S. Air Force made clear its counter claims.

• Overhauled the first operational USAF F-100 Super Sabre unit in Europe at a Berlin conference, press conference on the eve of the air show. The conference was attended by 130 reporters from seven nations.

• Flew the F-100 at supersonic speed before an air show crowd of 70,000.

• Gave European audiences their first view of the B-47 Strikewright jet bomber and the Martin-Paradeur tactical missile.

The Army put on exhibitions the Nike anti-missile missile and the Corporal and Honest John ground-to-ground rockets.

The NATO event had been called for as an obvious Defense Department effort to offset slackening European interest in NATO in the face of Russia's new "peaceful" line, and to reinvigorate confidence in U.S. strength.

The Russian lack for prestige was its most opposite.

Soviet military aircraft were not on display in their obvious Russian island, instead, upon an already highly publicized Tu 104 jetliner transport.

During the first day of the show, the show jet remained on static display, with only a limited, and apparently slight number of guests allowed to enter it.

On the second day, the Tu 104 took to the air for two passes—one at no more than 300 ft. over the crowd.

Experts at the show were unimpressed by both displays, but the U.S. had the larger selling job.

Along with the testimony of LeMay and Felt, European newspapers were giving prominent mention to threats in some quarters of Congress to cut off support from NATO nations which have failed to turn out their commitments, and a statement by the new NATO secretary, USAF Gen.

Louis Norstad, that his forces are still below the necessary numbers.

To point up the improvement of U.S. forces deployed in NATO areas, Maj. Gen. Robert M. Lee, commander of the 17th Air Force, and Col. John A. Woods, commander of the 56th Fighter Division, and at the Berlin press conference told USAF air power is Europe is new subject, including the Martin B-57, B-57, F-86, F-100, and the Mustang.

They also pointed out that the arrival of the F-100 in full operational combat operations possible for the first time and is "a sign of the maturity of the Western nations to put forth the strongest defense of freedom."

U.S. Latin American Show Is Rescheduled

Washington—The two-day international show planned to be held in Mexico City in 1955 has been postponed until the next after Thanksgiving, when it will be held in the city of Mexico. The show was scheduled for Nov. 14-15 at Mexico.

The conference originally was planned for February by the Aircraft Industries Ass'n's Export Committee, working with John P. Mac, AIA's executive director. After DeWitt Bowers, president of AIA, called off the meeting, stating it needed further study, Richard B. Swenson, Washington representative of the Committee, resigned as AIA Export Committee chairman.

New committee chairman is Charles H. Sheff of Western Electric International Corp.'s New York office, who was vice chairman under Swenson. Paine is retiring from his AIA post this month. He is being succeeded by Irving H. Zanker, an associate.

Civil and military aviation leaders from Latin American countries have been invited to the conference. Its purpose is to provide U.S. industry representatives with a better idea of the requirements of the Latin American market, where European aircraft manufacturers have been making substantial sales in recent years.

French Plan to Build Atomic Plane Engine

Two years after a government announcement that the French were planning to construct an atomic airplane engine the first step has been taken toward the realization of the project.

A new design devoted to the study of an atomic engine has been created at Suresne's Suresne plant just outside of Paris.

To direct the work of the atomic study laboratory, Suresne has appointed Raymond Armand, chief engineer of Suresne and one of the leading French reactor technicians. For the past eight years, Armand has been devoted to the French Atomic Energy Commission's research center at Saclay, where he has been studying the latest developments in French nuclear research.

Suresne refused to give any further information beyond the fact that it would "probably not work along the same lines as the American."

Chance Vought Awarded New F8U-1 Contract

Washington—The Navy has awarded Chance Vought Aircraft Inc. a \$20 million contract for additional production of fighter and photographic versions of the F8U-1 jet Crusader. Previous production contracts of 541 orders were awarded in March 1955, and 5100 orders were awarded in December. The contract increases the total amount of Crusader contracts awarded since Chance Vought won a design competition in May, 1955, to \$236 million.

News Digest

Douglas F4D now equipped with the F74 aircraft is expected to get the F74. General Electric is now flight testing the F74 as an F-4D. The F74 is expected to provide the F4D with a maximum ceiling as great as 50,000 ft.

Canada will build its F-102B with the F74 engine under a new \$55 million USAF contract. The contract is to build the aircraft of the Canadian Forces. First flight is scheduled before the year end. The F-102A with the F74 has flown at 54,000 ft., 2,000 better than expected. It is now being flown what is considered necessary.

Tactical Air Command may receive the Lockheed F-104 Starfighter. TAC has established a Starfighter project.

USAF Thunderbolt synthetic form is converting to North American F-100C Super Sabre and will make its first demonstration at its Super Sabre late next month at Florida. Thunderbolt has been flying Republic F-84's.

Official announcement of Canadian Noron as assistant Secretary of the Navy for Air (AW May 28, p. 25) was

announced last week by Navy Secretary Charles S. Thomas. At the time that Thomas conferred with representatives from that post of James H. Smith, Jr. Thomas and Smith, an assistant secretary since July, 1953, originally had accepted the position for a period of five years and had filed, at the personal request of the Secretary, a signed resignation to be in effect in 1958. Norcia, who has been in research and development consultant to the Secretary of the Air Force since 1953, is a Naval Reserve aviator and served as assistant chairman of the Civil Aeronautics Authority in 1955.

Boeing Aircraft Corp. has been awarded \$780,000 contract by Lockheed Aircraft Corp. for additional jet engine wing, supplementing a \$1,000,000 follow-on production contract received by Boeing in January.

Brain-to-machine translation of Russian technical articles into English as a word-for-word basis is goal of new development being launched at International Telecommunications Corp. under Rome Air Development Center sponsorship. As human operators type out words on Russian-to-English keyboard, an electronic typewriter will type out English copy into Russian English word processor which will store in high-speed memory data, capable of storing for million characters and converting any word in 50 milliseconds.

National Aviation Corp. offering of 131,323 shares of capital stock to stockholders at \$30 per share and ratio of four to one was oversubscribed. From subscription rights took up 136,411 shares. The balance, 1,912 shares, will be allotted among 79,936 subscribers pro rata to previous subscription rights were exercised.

Nike missile will be produced at Charlotte-Gastonia Missile Plant, which was dedicated recently. Douglas Aircraft Company will operate Arrowwood plant in its 80th division. Relocation from Lincoln questionnaire depot cost \$22 million.

Power out of more than 10% for Bunsenburner rubber, which has been in containers for guided missiles, are effective this month. New price for Kof F chamber starts on sliding scale at \$15 lb.

First Canadian private sponsored unmanned test laboratory is open at PAC Applied Research Limited plant in Toronto. Official Canadian in doors for the first time, wing wind tunnel, altitude temperature chamber, shock, air log and radio microphone tests. To be added equipment to test effects of sand and dust, copolymers and fungus growth.

Fang Stayed in Mockup Stage, But Paid Test Bed Dividends

By Richard Swerney

Hardiness, Glib—Northrop Aircraft's Fang (N-109), a proposed single plane, high altitude supersonic fighter, never got beyond the mockup stage but the company has found it an invaluable engineering and design tool designed for growth without modification and for a high degree of flexibility and maintainability, using new approaches and principles.

Fang design started in May, 1943. The mockup was done in September of the same year, and has been in use as a test bed for ideas since.

Reconstruction in principle and design details.

• **The** jet engine was not mounted within the fuselage structure, it was attached externally. Either the J45 or J49 could have been used, and the change could be effected in the field wing in 10.

• **Engine** section was used extensively, having a very high degree of upward mobility and maintainability.

• **Engine** people were allowed to place their hands in the aerodynamic envelope in case serious problems and structures were damaged around them.

• **A delta** (low aspect ratio) wing 9% thick was used, but a horizontal stabilizer was incorporated to obtain higher concentrations of high altitudes and Mach numbers than had been possible with pure delta design.

• **The** glass featured eight interchangeable armament configurations. (Change type cannons, 2.5 in. and other types of rockets, guided missiles and bombs without difficulty.) Changeover was in 10 sec and could be accomplished in the field.

• **The** combination of tapered pylons for reloading and seating of armament, single point high pressure reloading, resulted in a minimal mission turn around time of six minutes from touch down to liftoff.

Light Weight

The Fang was a light (11,000 to 12,000 lb.) aircraft, with wing loading as low as 55 lb./sq ft. A top speed of Mach 2 with the alternate J49 or better powerplant was planned. Using the same technique of trading speed for altitude, a maximum altitude of at least 70,000 ft. was expected. Structurally, Fang had four main fuselage longbones and stressed skin in the center and aft sections of the fuselage for a low.

Weight was a concern of what other

was would have been stressed skin was hinged sections and needed having a vertical duct which was incorporated in the forward part of the upper fuselage and aft the cockpit, supporting two engine mountings.

The engine mountings were not hinged below the horizontal fuselage box structure, making installation of multiple engine mounts for different powerplants easy in original production without too great a weight penalty. The engine mountings were in reality just a large casting, hinged in all sections for any engine access.

For different engines different cowls could be used without any modification to the engine access attachment to the main fuselage structure was along a hinge point.

Best Configuration

Any best configuration could be changed at will to test engine requirements since it was easily attached to primary structure rather than being a part of it.

In equipment placing, three items were required: least weight, most stable and aft the cockpit in the fuselage. These met through a wingach fuselage, hinged and rotatable section of part of the wing leading edge and fuselage and fuselage side panel.

The top of the fuselage forward of the instrument panel also was hinged for easy access to the back of the instrument panel and electronic gear in that area.

The nose section was variably hinged for access to radar and related electronic equipment.

Plastic Tubes

Gun Mast tubes were of plastic with stainless steel reinforcement. When a tube burned out, it was thrown away and a new tube installed due to the low cost.

In addition, the plastic design in that area made structural changeover by air easier since the proper section for the type of armament could be cut and quickly installed from the kit. Any of the eight armament configurations could be made in a maximum of eight man hours, two men working, four hours each, one on each side.

Fuel was carried integrally in the wing, and in bladder tanks in the fuselage, using the high end-wing and the wing through structure.

Fang would have cost more initially per pound of airframe weight than conventional designs.

However, in the life span of an airplane, its growth needs in access



gained through costly modification programs. The Fang philosophy evolved by Edgar Schmued. Northrop was particularly engineering, would have cut the modification costs considerably, making it, in the plane's complete growth cycle, being accomplished at a much lower life-span of this design cost.

The design was accomplished under the direction of Weldon Giesek, Northrop chief of preliminary design.

Many Fang modifications will be included in future Northrop designs, and the first undoubtedly will be the supercruise burner now under construction.



ARTIST'S conception of Fang in flight (right) and in static (left) as well as its J49 engine in operation (below). (Below) shows view of nose section. Note (1) below provides access to radar and forward electronic gear. Fuselage (2) opens to back of instrument panel. Other electronic gear, instrument panel (3) opens for air servicing or finger-point changeover, and (4) engine cowls can be removed for service engine change or installation of a different type of engine.



AIR TRANSPORT



DC-7C Lengthens Transocean Stride

Three spectacular proving flights precede the first scheduled nonstop New York-to-Paris service.

By Robert Egan

New York—Pan American World Air Lines begins a new era of transoceanic operations last week with first regularly scheduled nonstop New York-Paris service using the Douglas DC-7C.

Regular DC-7C passenger service was preceded by three spectacular proving flights that set the new transport striding its legs to set three new nonstop transoceanic records between the United States and European continents. They were:

- 4,840 mi. nonstop from Miami to Paris in 15 hr. 55 min., averaging 310 mph, ground speed and burning 7,195 gallons of the 7,524 maximum fuel load.
- Reverse over Paris was sufficient to set an Miami-to-Panama at 4,060 mi., nonstop from Frankfurt to New York in 33 hr. 10 min., averaging 330 mph, ground speed against an average 15 mph headwind. Fuel consumption totaled 6,700 gallons, fuel economy to be either Chicago or Atlanta as alternate.
- 4,900 mi. nonstop from Rome to New York in 35 hr. 57 min., averaging 278 mph.

Strong Impact

Step climb procedure was used; the first four hours flew at 13,000 ft. before climb to cruising altitudes above 36,000 ft. This Rome flight was the end of a DC-7C proving flight covering all European terminals to be used by the new transport. It was conducted under long-range cruise procedures using low cruise power for better fuel economy.

Techobs observers aboard the jet believed DC-7C transoceanic cruises will be more rapid than the new transport will have a strong impact on long-range

transport operations in the years to come, before turbojet transports go into service.

Fast machines in the new nonstop pattern came from behind where the Irish government, apparently aided by the DC-7C ability to over 30,000 ft., secured permission for the gross flight to fly over Irish territory on the way to Paris.

Pan American will be using heavily used DC-7C fleet, the 10 model, that began entering service last year and the C model, to boost its transoceanic seat capacity from 30,000 in 1955 to a total 130,000 this year. In addition to the five deliveries already made to PanAm for the Paris service began last June 1, Douglas is still operating three DC-7Cs for development testing.

Pan American is scheduled to get deliveries of two a month until mid-March when its last of 25 planes will be complete. Each delivery is Douglas built Pan American to get the DC-7C into regular service a month ahead of its July 1 target date. Present schedule calls for 11 to be delivered 148 to be ordered.

Reconnaissance Airlines Service will be the first airline to get the DC-7C but deliveries are scheduled for July. Pan American is particularly pleased with the color flexibility of the new



Nonstop flight to Paris, New York goes DC-7C long-range

tracks and reasonable bulkheads of the DC-7C that enable a quick change to suit of these cabin arrangements to the airline plans to use. They are:

- 78 passenger layout, version now in service to form. This has a thousand two seating arrangement with 35-in. interval between seat rows, five and six foot intervals, and a mid-cabin galley and lounge.
- 144 passenger version that will be used for Pan American's third-class service if its proposed low fares are approved by the International Air Transport Association traffic conference in session at Geneva.

• Combination features deeper access to the rear cabin, tourist accommodations from forward to rear decks, routes such as the South Africa, Scandinavia and round-the-world services.

Sooner and Better

The speed with which Douglas and Pan American put the DC-7C into active service is characteristic of the pace with which the entire project has been handled. The project was first conceived June 7, 1954, by the Douglas engineering group headed by R. McGowan, who directed DC-6 and DC-7 series engineering. Corporate approval was given by Donald Douglas and the first conferences were held with Pan Am President Jan Toppie and his technical adviser in June 1955.

PanAm's initial approval was received just three weeks after the DC-7C project was conceived although a formal contract for 15 aircraft was not signed until a month later. In a span of a month of two year long conception the DC-7C went into regular service service. Pan American expects to put the DC-7C into Pacific service by September and hopes for approval of Coast Circle cruise agreement by the Dec 1st for this transport. The DC-7C will make a Seattle Tokyo run of 4,770 mi.

nonstop and a one stop run from Seattle to London via the pole route.

Coming at the end of the long Douglas DC-6 and DC-7 series development, the DC-7C has emerged swifter and better than originally scheduled Douglas deliveries to Pan American to begin its work rather than integrated

Certification Performance

Total of 315 DC-7Cs have been ordered by 12 airlines representing about two times production of this type on the integrated DC-6 and DC-7 production line at the Douglas Santa Monica Division. It also can be

it will be delivering 144 transports a month.

Certification performance of the DC-7C has exceeded its original sales contract guarantees by a significant margin and a number of improvements are still being worked into the aircraft for even better operational characteristics.

- Among the various areas where performance has exceeded guarantees are:
- Gross weight up from 118,000 lb. to 141,000 lb. with 144,000 lb. as its maximum performance limitation.
- Take-off distance cut from 6,918 ft. to 5,370 ft. at maximum gross.
- Landing distance has already been cut 30 ft. to 5,150 ft. at 107,000 lb. aircraft weight with additional improvements aimed at bringing the landing requirement to 5,000 ft., or less than now used by the DC-6B.
- Rate of climb has been increased and stalling speed lowered.

Engine improvements proposed by Curtiss-Wright will increase cruise power of the R-3350 turbo compound engine to 1,750 hp at 14,000 rpm and 3,800 hp in low boost. This engine improvement is expected to increase cruise speed to 375 mph and offer faster climb to cruising altitudes. These improved engines will be available for use in a number of the DC-7C.

Addition of turbochargers on the 1440 diameter four-bladed Hamilton Standard propellers is expected to reduce the already extensive low altitude speed.

BOAC Financial Loss Predicted

London—Financial difficulties within British Overseas Airways Corp. were revealed last week by the company's new chairman, Gerald Durrant. In a statement read at a company staff meeting, Durrant predicted the company will incur a loss of \$4.1 million this year and during the present fiscal year ending March 1957.

The tone of the statement was in marked contrast to the annual report of a year ago when BOAC only was said to have a profit of \$4.9 million without the difficult underwriting of a possible loss in the future.

The company said, however, that past losses of the financial director are not said in its annual report.

On the same day at Durrant's statement Mr. Durrant announced in effect, a protest of its top status in a corporation. This appears to be in line with the financial outlook.

Durrant's statement was based partly on the report of a committee set up May 2 to examine aircraft requirements during the next five years. It was reported that nearly half the

deficit was expected because of the financial cost of introducing the Britannia into BOAC service. This costly non-stop producing re-equipment and crew training, and the losses of low flying aircraft expected during the next year, the prediction, however, another net is \$2.1 million for wage costs, which \$1.1 million in recently awarded pilots.

The introduction of DC-7Cs will not reflect in the present financial year as they are not expected to service until the last period.

One of the proposed changes involves the movement of operations director Sir Victor Topp. His post has been discontinued. Two new posts—chief of flight operations and chief of ground services—will report directly to the managing director. They will be filled with appointments. The chief of ground operations will be filled by H. H. Hinchey, present deputy operations director.

The other top positions—director of aircraft services and supplies manager—are due to become vacant soon.



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Capital Calls for Common-Stock Increase

By L. L. Day

Washington—Capital Airlines has called a special meeting of its stockholders on June 22 to ask for an increase of capital stock from an authorized one million shares of common stock to 2.5 million.

According to the proxy statement, the company has under consideration the issuance of convertible subordinated debentures in the approximate amount of \$12 million. The increase in capital stock to support the convertible debentures is necessary since only 98,443 shares of currently authorized stock remain unissued.

If the debentures are authorized by the board of directors, it is probably would be in twenty years with an interest rate of between 4% and 5%. Net proceeds would be added to the company's working capital to finance the operation of new equipment over its new routes. There is no indication that funds would be applied directly to the purchase price of the 15 Boeing 707-120 aircraft the airline expects to order (AW May 28, p. 44).

Should the debentures be authorized, the company would enter into an agreement with underwriters for their sale. Underwriting conditions would be fixed as to selling to market conditions at the time the offering is made. The debentures would be issued under an indenture with a trustee to be selected.

Conversion Plans

Capital estimates that between 180,000 and 175,000 shares of the proposed new stock may be required as a means for future conversion of the debentures into common stock. The balance of the new stock will not be offered in a public sale but will be held for any future requirements of the company. Relative rights of Capital's stockholders will not be changed under the proposal.

This is one of the last steps that must be taken in the conversion of the equity-type securities to finance transitional costs of moving into the jet age. Capital Airlines recently obtained authorization to issue its common stock from its \$12 million in convertible debentures, although the company announced last week that the planned offering of additional stock to shareholders was being temporarily postponed. The airline originally had announced its intention of raising about \$15 million through the sale of 1,100,000 additional shares.

American Airlines followed a similar pattern in 1945 when it financed a fleet of Cessna 340s and Douglas DC-6s through the issuance of 310 debentures and 5.5% convertible preferred stock. Funds resulting to issue \$80 million marked American's first in a strong advantage by being the first to place post war equipment in one position against converted C-54s and pre-war DC-3s.

Capital's entry into the turboprop field ahead of the rest of the airlines places the airline in an enviable position. Thus far, however, the airline's financing its re-equipment program without the benefit of long-term loans.

Viscount Financing

The \$71 million purchase of the Viscounts is covered by monthly payments over a period of five years at an interest rate of 1.75% in excess of the Bank of England rate in effect on the date of payment. Maximum interest charge is 6.25%.

United, American and Eastern Airlines have completed long-term loan arrangements with insurance companies for their jet programs. National Rental and others have reached similar agreements for long-term loans with various banking groups.

Unlikely, however, since conversion can be used to meet additional needs of many capital to cover such transitional costs as training, parts and tools and revised maintenance and operations procedures. In addition to the risk of new securities long-term loans must be supplemented by proceeds from the sale of equipment, retained earnings and depreciation.

Examiner Warns Aero-Peninsular

Tennessee suspension and a warning to operate under the law are pending against Aero-Peninsular Corp. by the Civil Aeronautics Board's examiner in the Aero-Peninsular Compliance Case. CAB Examiner Edward W. Stobbs found Aero and Peninsular guilty of continuing operation and flying a regular service in violation of the Civil Aeronautics Act.

Stobbs advised the Board to suspend Aero and Peninsular's operating authority for 90 days and to order the airlines to cease and desist from violating the act in future operations.

The carrier has been guilty of these offenses, according to the examiner's report, with actual negligence, operating with irregularity, in combination with each other and operating with irregularity in combination with each other and with a third party.

Aero and Peninsular have operated largely between Miami and New York.

ships, and short term loans.

Due to the nature of the national program about 10% of a debenture's value will be in a debenture's value will be in a total investment. In 1940 roughly three times as great as in 1941. Net operating income required to provide National with 7% net income after taxes is such as an interest will cost \$11.

Stobbs, Glendon, vice president of the Air Transport Association has no planed before the House. Aero-Treat Stobbs indicated the importance of the airline reaching an agreement with a third party which would insure new money at favorable terms. He said that a substantial part of the \$1 billion the airlines will require during the next five years must be forthcoming through private financing.

An indication of the lack of appeal the airlines present to investors according to Glendon is found in the building of some 1,000 additional shares of the Aero-Peninsular group. Of the 12 domestic trunk lines, the common stock of only four airlines has found its way into their subscribers' portfolios.

In no case he added, does the appropriate holdings of a single airline's common stock compare more than 1% of the outstanding issue.

and Chicago, with occasional operations between Miami and Norfolk and New York and Buffalo.

Aero-Peninsular is associated with the two irregular carriers in the report as formerly known as Safeway Travel Service. In 1951 the agency changed its name to South East Airlines Agency.

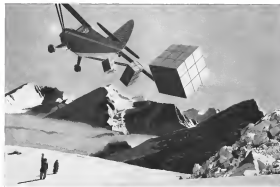
In recommending that the CAB punish the carrier with suspension rather than revocation of their authority, Stobbs pointed out that the Board itself has prescribed a maximum limit set of rules for suspension as a warning.

Stobbs concludes that "Aero and PAT should be given one more opportunity to demonstrate good faith and compliance with the provisions of the Act and the Board's regulations."

If they continue to operate irregularly, the carrier's operations in violation of the operating authority of the public carrier.

PLANE FAX

by STANDARD OIL COMPANY OF CALIFORNIA



Delivering groceries to the Sierra crest

Scowhounded in June? Every year from November to the first days of summer, a sawcutter requires and his wife are isolated in their knee-high in the mountains north of Lake Tahoe. And each month Miss Jones, a grocer of Gardnerville, Nevada, flies over the Sierra Nevada's crest to drop fresh vegetables, meat and milk into the salt sawcutter's piled near their door.

"Much of the trip is low-level flying," says Mr. Jones. "In spite of going over the top at 10,000 feet I don't have much room to spare. But even in a dividend I get all the power

I need with Chevron Aviation Gnatolls 80/87 in our Stinson's Lycoming. Chevron 80/87 gives me performance to spare when I'm climbing, get I can lean down for real economy to level flight. Burns clean, too, never loads plugs.

"Flying over this kind of rugged wilderness calls for a really dependable engine. One has 500 hours on it now, and RPM Aviation Oils have kept it good as new. Compromises is still up to factory standards. It's never missed a beat, always runs smooth as a watch. All the way to I've flown. I've never had engine trouble using 'RPM'."



TIP OF THE MONTH

Downclimbers are often violent near the top of a mountain range. Mr. Jones advises flying on the windward side of any ridge or promontory, then you can turn around if you hit a pocket.



We take better care
of your plane

STANDARD OIL COMPANY OF CALIFORNIA



TEACHERS RECEIVING instructions before flight. Note handling in rear, displaying forward

Eastern Flights Teach Teachers

Baltimore, Md.—Eastern Airlines is making big for the aviation industry, a whole with its "children's flight." Some 50,000 school people have been given rides on Eastern airlines along with lectures on the construction of the industry during the last two years. A good example of the teacher presentation program took place at a recent Saturday when 1,200 public school teachers were entertained at Baltimore's Friendship International Airport.

Eastern hasn't exhausted the root of the long-agoed flight, but today's operation can be up as many as three airplanes, along with relief crew, ground personnel and ground equipment. However, the airline is convinced that enough new business is being generated to meet that need the root, not to increase the long-range value to Eastern and the industry in producing a level of its trained education.

To undertake the scope of the stepped market for air transportation among the professional group alone, Eastern points out that 75% of the teachers it admits have never flown before. That adds up to 90,000 first riders who have had their initial flight experience under the program so far.

The teachers begin arriving at Friendship around 8 A.M. under a tight schedule set up through their superintendents' office. During most of the day, two flights were landing and taking off at 77 min intervals, including 40 teachers from the front of a plane as 40 more veterans at the rear.

At last, however, out of the aircraft took up a platoon of people craved by the school superintendent for flight engineeers of Eastern.

To handle this typical flight, the airline used three crews, eight teachers, and seven ground crewmen including the local station manager.

When sitting up a particular flight, an Eastern representative with the school superintendent of the selected city, two to three weeks in advance. The invitation is extended, and being up and delivering the teachers between the school's airplane's responsibility. Any local press coverage also comes through the school rather than through Eastern.

Not that the airline discourages such publicity. It has the local angle hand, e.g., two pilots whose hometowns in California, O., were pulled off duty elsewhere in the nation to handle the Saturday night. Some of their old teachers from public school days were photographed with the pilots and both local papers gave the story a nice play.

But it is a "soft sell" operation as far as Eastern is concerned with the emphasis on aviation rather than the airline as the level pilots delivered to each group of teachers before the airplane.

At every location, Eastern sends its spot plane with school, spot plane, news gear available, and the flight-day as an about face open's replacement, down on arrival. In some cases landing steps have been trained in from other stations to handle the flight.

Of the public school teachers who have been offered or left side about 80% have accepted. In particular, which the acceptance rate has been about 95%.

apportion to handle "May" opening as flight to Miami.

Trans World Airlines promises to buy eight Lockheed 1049G and 75 Lockheed 1049G aircraft from Hughes Tool Co.

Trans Pacific Airlines is preparing to lease a DC-7 aircraft from them 11, 1955, to mid-June 30, 1957.

South American companies to enter Washington through Washington National Airport and in Friendship International Airport.

Flying Tiger Line's position for cross-reduction of other CAB action during its exception to permit transatlantic charter flights by the Western University. Trans Pacific, Pan American, Trans World, Travel Center and San Francisco State College, in exception to permit a transatlantic charter flight by Temple University also are granted.

AGREEMENT

Agreements between Northern, Canada and Western. When Alaska Airlines and Western Transport ending the loss of routes C-46 aircraft by NCA and Western for its subsidiary companies. Western was granted an exemption to provide the services involved.

New York Airlines' flight pattern review which also involves service on one-way mail and cargo flights between Los Angeles and Oakland. Also, daily service between Seattle, San Francisco and Los Angeles.

Between airlines C-11, Pan Am, D-1, Martin, Trans World Airlines and Hughes Tool Co.

Agreements between various routes approved by the International Air Transport Association relating to the government routes baggage transportation form.

ORDERED

On Air Lines to their route why the Board should not on temporary order rates of \$2,225.00 per month until April 15, 1955, to May 15, 1956 and 1957, ends a sale for the period during April 1, 1955.

Bureau Air Lines to their route why the Board should not on temporary order rates of \$2,225.00 per month until April 15, 1955, to May 15, 1956 and a riding rate rate formula based on annual rate of \$2,225.00 for the period during April 1, 1955.

Appointments filed in Board: Service Dells Air Lines National Airlines, North American Airlines, and other flying Club of Nashville and City of St. Louis per solid with the St. Louis-Seattle Service Club. Air line service authorized in St. Louis, which service in St. Louis per solid with the St. Louis-Seattle Service Club. Air line service authorized in St. Louis per solid with the St. Louis-Seattle Service Club.

Shortlines

► Air India International will accept delivery this month on the first of three Super-C Constellation air orders. The new transport will be used on routes to Great Britain.

► Algonquin Airlines is using 15 Air France Constellation aircraft in its service under a six-month program it has

CAB ORDERS

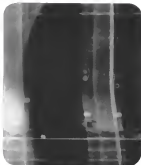
(No. 1-75)

GRANTED

When S. Maine an exception to open its Atlantic route, continued to United States pending a CAB decision on its



Radiograph and replication of a failed cap and wing component used in this National DC-7 crash. Now their radiographs are ready for viewing in 30 minutes.



Radiograph showing pressure trail on National Airlines DC-7 where wing stringer meets fuselage.

**a 24-hour job...
now takes**

**1 hour with
Radiography**

Among the thousands of spare National Airlines regularly safety-checks its planes are the pressure seals where wing stringers enter the fuselage. It used to mean a 24-hour job—until radiography took over. Now it takes an hour.

This shows again the importance of radiography in making inspections, whether

of assemblies, welds or castings. It can save time—can save money—can build suppliers' reputations for producing and delivering only sound work.

If you would like to know how radiography can improve your operations—call your x-ray dealer. He'll be glad to talk it over with you.

EASTMAN KODAK COMPANY
X-Ray Division
Rochester 4, N.Y.

Radiography...
another important example of Photography at Work

Kodak

cattled Propriet Losantos. The project is designed to provide foreign travel from Albuquerque's service area and create better understanding of American aviation, then by foreign airline flight personnel.

▶ **Aerovias**, the Colombian airline, has signed an exclusive agreement with Scandinavian Airlines System to carry 345 passengers between New York and Colombia.

▶ **Bozell Airways** will use Anconaircraft popovers as the Alhambra 501 engine specified for the carrier's order of nine Lockheed Electras.

▶ **KLM Royal Dutch Airlines** will re-significant service to Budapest, Hungary, and Sofia, Bulgaria, this month with a weekly DC-6 service from Amsterdam.

▶ **KLM** has ordered five bi-bleed Hamilton Standard turbofan engines for its Lockheed Electras.

▶ **Middle East Airlines** began Vancouver service to Paris and London last month with two flights a week. The carrier also has added an Athens-Vancouver Zurich route and a direct service to Rome.

▶ **North Central Airlines** reports that traffic for the first five months of the year is approximately 50% above the same period last year. North Central has started its summer service to Rapid City, Wis., with two flights daily.

▶ **Northwest Airlines** has signed a new 35-month agreement with the Boeing Co. of Boeing and Boeing Co.

▶ **Over Air Lines** carried 65,526 passengers during the first quarter of the year, 28,475 more than in the first three months of 1955.

▶ **Pan American World Airways** has added a fifth weekly round the world flight. The flight operates with transatlantic schedules at London and New York to Los Angeles via Frankfurt, Istanbul, Ankara, Vienna, Karachi, Bangkok, Hong Kong, West Island and Honolulu. Pan American has added Venezuela for passengers to establish Western firm between Caracas and New York.

▶ **Swedish Airlines** flew 2,795,416 lb of freight in April, an increase of 55% over the previous April.

▶ **Sabena** Belgian World Airlines will offer eight new routes to Rome this summer. The firm, merged through agreement with Aeroflot, the Russian airline, and the USSR International Travel Bureau, says from \$1,395 to \$1,880 and from 11 days to 31 days.

COCKPIT VIEWPOINT

By Capt. R. C. Robson



Standards for New Instruments

A new way to start an argument is to bring up the subject of instrument panels. Since it is of interest to authors, it seems that has ideas are the best. This issue is with several hundred "best" arrangements.

Some years ago the SAE appeared its new Instrument Committee 7 to bring order to the chaos by developing a standard grouping. Their first recommendations were accepted by most of the members and probably some of them also have been put into the cockpit.

Normally, the SAE people designed their layouts for three-needle instruments which were available at the time of their deliberations. But, like all benefits of aviation, progress marches on in the science of cockpit design.

We now find numerous combinations, as indicated, instruments on the standard while the standard provides for the old-fashioned ones. And how we go about it.

Second Rate Method

Of course the new way can be used in the old layout. But this is a second rate method and does not make best use of some of the desirable features of these combination instruments. In fact, the fact that better aircraft are now being introduced to our transport fleet, and each one has the need for more precise flying, it does not make good sense to lose even a small part of the advantages of modern design.

In an effort to secure the maximum benefits from the newest instruments several groups of airline pilots have formed their own standards for a single design (AW March 20 p. 92). Basically we might call this arrangement a cross-line system. That is, the most essential flight instruments are placed in the top row for horizontal viewing—put in the pilot's window the attitude of the aircraft.

Navigation data is positioned directly in front of the pilot in a vertical line just as he visualizes his flight path.

Pilots Recommend Layout

Pilot recommendations from American, Boeing, Eastern and National, to name a few, have recommended that there be three rows of instruments. The top row of instruments should be placed in the pilot's window so that they are directly in front of the pilot's line of sight. The second row should be placed below the first row and the third row should be placed below the second row. The third row should be placed below the second row. The third row should be placed below the second row.

Effective is a big word in this discussion. These new standards will have to be flow effectively to lower expenses and on some points trade-off. This is to produce the expected return for their cost. And equally obvious is the fact that the more expensive is added on to the flight instruments, the less the plane follows.

Speed also is important here. Everyone is anxious to put the new set on the air at the earliest possible date. Orders for these new ships have come in fast, and delivery is so close, that it has been impossible to go through the usual extensive, two-year construction studies on every item of instrumentation, it just one item—but a most important one—on which rapid action is needed.

The ALPA has already petitioned the CAB for permission to use the new combination instruments in accordance with pilot wishes. Pilots would like to see standardized panels. But there is also a strong feeling that new aircraft and new instruments should not be introduced because of old standards.

A LINE OF 3000 PSI COMPRESSORS

DELIVERING FROM 1.8 TO 16 SCFM

by STRATOS

Stratos compressors for high pressure pneumatic systems cover a wide range of rated volume delivery and applications.

Models are available either as complete packages, or as basic compressors only. Complete units include electric or hydraulic motors, interstage coolers, moisture separators and automatic controls. Certain models can be ordered with or without controls, with provisions for a variety of drives—electric, hydraulic or turbine. For the basic units, controls and auxiliary equipment such as gas-coolers and after-coolers can be provided to match the specific aircraft requirements.

Installation of the packages is simple, requiring only four mounting bolts and connecting to the high pressure air lines and electric or hydraulic service of the aircraft. Automatic controls, standard equipment on all compressor packages, provide a minimum pressure differential of 100 psi between shut-off and turn-on pressures. The allowable shut-off pressure range is 2950 to 3050 psig, and the allowable turn-on pressure range is 2700 to 2950 psig. A relief valve prevents overpressurization.

Light and compact, each compressor is designed to operate over a wide temperature range—from 65° to 165° F. Integral cooling fans are standard equipment on all units.



Model PCM3



Model T63



Model 6071-1



Model T63

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Nominal inlet—11.1 SCFM @ 100 PSI inlet
No full-flow with altitude when
pressurization is available
Controls and moisture separator available
Suitable for electric, hydraulic or turbine drive
Weight 31 lbs. without motor.
- T63 Delivery—1.8 SCFM**
Complete package including controls,
moisture separator and 400 cycle motor
Weight complete 131b. lbs.
- T640 Delivery—1.8 SCFM**
Complete package including controls and
moisture separator
Control speed 1 gpm hydraulic motor
operates on 2700 to 3000 psig
When operating under 80° F, full rated
output is maintained from sea level to 10,000 ft.
Weight complete 30 lbs.
- T634 Delivery—1.8 SCFM**
Complete package including controls,
moisture separator and 400 cycle motor
When operating under 80° F, full rated
output is maintained from sea level to 10,000 ft.
Weight complete 131b. lbs.
- T636 Delivery—2.8 SCFM**
Controls not included—can be provided
as a separate package • Hydraulic motor drive
inlet can be pressurized • Weight 81 lbs.
- 6071-1 Delivery—1.8 SCFM**
Complete package including controls,
moisture separator and DC motor,
Weight complete 31b. lbs.
- T606 Delivery—1.8 SCFM**
Complete package including controls and
moisture separator
Control speed 1 gpm hydraulic motor
operates on 2700 to 3000 psig
Weight complete 131b. lbs.
- T664 (available upon Delivery—1.8 SCFM**
A simplified 1-1/2-gal compressor
with 400 cycle motor
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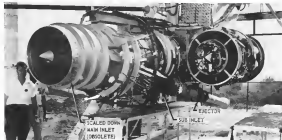
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DOUBLE PODS in B-58 powerplants were shrouded by cowling, which would have required severe wing bending problems.

B-58 Foreshadows Mach 2 Powerplant

By David A. Anderson

The parties for one type of powerplant installation in the next generation of Mach 2 aircraft has been set by the four podded units of Convair's B-58 Hestley weapon system.

Features of the podded powerplants include:

- Variable geometry of the inlet automatically controlled to maximize mass flow efficiency
- Sub-inlet systems, handling the tremendous volume of flow to cool and ventilate the engine and its accessories
- Consideration of the thermodynamic

of the installation as a system, rather than as a number of separate additive and subtractive items.

Wasteful Description

The B-58 is a weapons system, not merely an airplane. Its primary role is that of a strategic bomber with nuclear capability at delivery speeds of Mach 2. Consideration of the design for other roles—notably as an early in the long-range intercontinental power—leads to the versatility of its concept, with weapons and weapons carrier designed in mind and parts of an aerial delivery system.

Powerplant is a quartette of General Electric J79 turbojets, podded into-

ally four core compressors of the same size applicable to the Convair F-103A suggested a similar look at the B-58. The result was that the four pods are used in 65 in the rear diagram to approach an ideal distribution. The final layout is an unusual one.

General characteristics of a typical podded turbojet for a Mach 2 engine were spelled out two years ago (AWE, July 12, 1954, p. 28). The Convair B-58 pods follow the basic scheme described there.

The basic problem is that in the installed weight of the engine plus fuel is a governing design factor in supersonic airplanes. The weight of the complete powerplant may be as much as 70% of the gross weight of the engine.

Fuel Plus Engines

The volume of fuel plus engine is the biggest factor in determining the overall drag of the airplane. Anything done to minimize the drag of the engine and the fuel is a step in the right direction.

Almost all of the problems in developing supersonic thrust for continuous, reliable weight and size from the aerodynamic characteristics of the engine.

The key to supersonic airplane performance lies in the inlet to the engine. Convair's staff, its staff limits, early forecasts and even structural features of the compressor blading or inlet duct

can be traced to poor inlet.

Convair engineers, with those who are signs in mind, made early studies of the inlet system and arrived at a final choice. A B-58 pod has a multiple shock inlet, with variable geometry automatically controlled.

The design engineers were built around a single point.

Maximum value for the difference between thrust and drag at both subsonic and supersonic speeds.

Tight wall materials and several hand-drawn test boxes were used in developing the final inlet system configuration. Plans of the distribution at the engine face for many flight conditions were sent to General Electric for aerodynamic analysis to check J79 performance.

Secondary Air

Rear on, taken through a number of sub-inlet located downstream of the main inlet for the powerplant, is used to cool the engine oil, the hydraulic fluid and the compressor bleed used for cabin conditioning.

Three water-cooled coils are used. The coolant air, after flowing through them, passes on downstream over the engine and the accessories to help reduce the local temperatures and is exhausted at the rear of the nacelle.

For flight speeds below Mach 0.6 and all ground operations, a cooling door is opened in the side of the nacelle because the normal pumping action at the secondary air exhaust is not great enough to overcome the negative pressure of the inlet duct. Some of the air entering through the cooling door flows in reverse through the cooler, and the rest of it follows the normal downstream path over the engine and accessories.

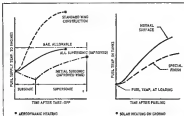
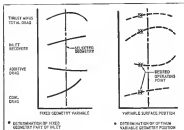
The sub-inlets were developed under a separate wind tunnel program because the original models for the main inlet had the wrong boundary layer conditions.

The engine air order provided the toughest problem in the sub-inlet system.

The length available for the duct was very short, and the thrust of the duct had to shock to throttle the flow in some flight conditions and operate very close to choking at others. Final configurations were combined, after a separate test of a wooden model of the duct, with the cooler tilted instead of being normal to the flow.

Thermodynamic System

Engines and aerodynamic testing pose some problems for designers of supersonic aircraft. Convair's B-58 was one of the first designs where the thermodynamics of the entire airplane was considered as a system, instead of



BASIC LAYOUT of the B-58 powerplant without the sub-inlet system.



B-58 NACELLE ready for test in flow cell of Arnold Engineering Development Center of AEDC. Right-angle construction is necessary to handle sub-inlet flow for secondary air system of the double supersonic burner.

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LIGHTWEIGHT AIRBORNE CONVERSION EQUIPMENT



MODEL 28V100

Inputs: 115 to 240 volts, 2 phase, 400 cycles
Outputs: 28 volts DC, 100 amperes
Regulation: 20 to 30 volts at 100 to 100 amperes
Weight: 10 to 15 lbs.

Chatham Type 28V100 is a major step forward in the design of airborne power supplies. Employing long life, lightweight CHATHAM krypton Selenium Rectifiers, this 100 ampere power supply provides substantial weight savings, greater reliability, improved electrical characteristics and reduced size. Featuring ruggedized construction throughout, Type 28V100 exceeds the requirements of MIL-P-7212 specifications. For complete information, call or write—

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being tackled piece by warm piece.

One of the first heating problems arose in early considerations of engine mounting. With a delta wing layout, the first guess would be placed ahead of a rather long wing chord. General engineers believed that the wing heating from the jet exhaust would be a critical condition.

Early studies showed there really was no light problem, but on the ground heating would be critical. Tests were set up using a General Electric J47 engine to simulate the jet exhaust. The simulated pod with twin engine-mounted heated the wing to a temperature that posed a serious structural challenge.

But area rule applications dictated separation of the engines. Even though the wing heating problem was focused in the choice of pod geometry, it could have been further aggravated by the aerodynamic needed for optimum pod geometry during cruise conditions. The compromise was made between optimum aerodynamic and wing heating.

Heat Increased

The current use of thin wings necessitates to handle the same heat means that there is a high ratio of surface area to internal volume. This increases the amount of aerodynamically generated heat transferred to the fuel during flight.

Converter structures designers developed a type of wing construction which had the insulating properties and, in addition, was lighter and stronger than conventional wing construction. Other studies developed these light and good handling techniques to reduce the effects of heat transfer during a typical mission.

Subsonic cruise for a short time before the supersonic dash to the target and return to subsonic cruise eases their dilemma.

- Use of a special fluids to reflect away solar radiation while the plane is on the ground.
- Mission planning so that loaded airplanes don't sit on the sun-burned asphalt during flight.
- Use of insulating screens to protect the wings on the ground.
- Ground refrigeration.

Several heat transfer specialists were assigned to full-scale study of the B-1B thermodynamics.

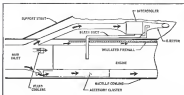
Data thus supplied was used as a basis for selecting lubricants, materials and allowable stresses.

No Firewall

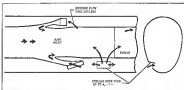
The structural firewall off of the compressor stages has been replaced by a lot of airflow straight through the space between the engine and cooling stages of the compressor case and



SEPARATE wind tunnel program used wind model of subsonic to establish configuration



INTERNAL arrangement and secondary airflow system in high-speed flight is shown



NEGATIVE duct pressure level on ground and at low speed cruise causing these warnings



JET BLAST EFFECT, coping with pod geometry and nozzle aerodynamics, is tested

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Dynamic Integrating Gyro Servo Table



Greenleaf Manufacturing Company, as a producer of Integrating Gyros, realized the need for a Dynamic Integrating Gyro Servo Test Table. This Test Table was designed and developed to facilitate the evaluation of Integrating Gyros, and Greenleaf now makes this valuable test unit available to industry.

The Gyro Servo Test Table can measure the following characteristics:

1. The drift rate of the gyro unit.
2. The current product angular velocity sensitivity ratio.
3. The characteristic time.
4. The angular velocity input voltage rate output sensitivity.
5. Minimum rate detectable.
6. High limit angular velocity deviation of performance.
7. Low limit angular velocity deviation.
8. Signal generator linearity.
9. Torque generator linearity.

Since a time interval meter is incorporated in the system, the following data can also be obtained:

10. Spin motor excitation frequency.
11. Spin motor excitation voltage.
12. Spin motor excitation current.
13. Signal generator excitation current.
14. Signal generator full output voltage.
15. Gyro damping gap temperature.
16. Accurate determination of the input axis.

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hood manifold temperatures down; them to be almost as high in the "hot end" of the engine, and in any case, in excess of those required to give spark across ignition.

There is a firewall separating each spark from its support that to keep an engine hot from spreading to the wing.

The exhaust also will be installed to separate the steel from the wing. The steel is to be ventilated and the firewall insulated to keep heat from igniting should it drop down into the wing.

Convincer Studies

The B-36's electrical and hydraulic systems are driven directly off the engine drive shaft rather than using a separate motor, power unit. Convincer studies indicated there was appreciable loss performance penalty doing this providing the frontal area increase could be kept to a minimum.

One layout considered was an in-line arrangement of the accessories, with the master hydraulic pump in the drag shadow of other engine accessories.

Convincer has been making an extra test program of the B-36 power plant on the ground and in simulated flight.

Tests have been made with a built-up complete prototype of the engine Test Facility of the Arnold Engineering Development Center at the Air Research and Development Command.

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"Supersonic Bomber Population Problem," in *C. D. Minter, Jr., SAC*, Page 745.

Figure, 14-1, Air Defense Control for "Supersonic Bomber" in *Reduct*, The new *S&P* Paper.



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Driving support struts in exhaust case of jet engine (Hesseltine Co., Phila.)—another blind-fastening job easily finished with Du Pont Aircraft Rivets.

Du Pont Aircraft Rivets are designed to meet severe strength and space requirements of today's high-speed aircraft. They retain high strength at high temperatures... set easily from head side. Du Pont offers nickel rivets for use in temperatures up to 800°F, and A-286

Superalloy rivets for use to 1400°F.

WRITE for specifications and design possibilities of these heat-resistant rivets: E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Delaware.



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"ULTRACON" RUBBER was built by Barber-Colman to Sperry requirements for gear assembly in test stands of its. Sperry engineer Charles Allen looks for hard conditions with a few parts required. Future design plans to increase the test gear.



Sperry Invests \$500,000 In Hunt For Most Accurate Gear Ever Cut

Sperry Gyroscope Co. is trading half a million dollars for 20 seconds, the expected angular error in sets of cast stainless-steel gears planned to be the most accurate ever cut.

Needed for gas turbine control systems for missiles, aircraft and ships, the gears are to be cut on a special "Ultracut" lathe built by Barber-Colman from Sperry specifications. One special feature: Sperry assumed the responsibility to check the machine during its construction, and Barber-Colman guaranteed the test the machine, but its final product.

The lathe was built in about a year and one-half from contract to delivery.

Angular Error

Sperry's requirements were for gears of about four-inch diameter which had to have ten adjacent teeth spacing accurate to 10 seconds or less of angle at any point and in any direction along the tooth profile.

Goals like that hadn't been made Sperry's own manufacturing equipment was at the upper limits of its accuracy, and a series of more than 100 stand-up tests had to be done. Barber-Colman was the only vendor willing to attempt to meet the requirements.

Sperry had one, built its own no lathe manufacturing research laboratory and started to investigate the problem. New measuring equipment, new holding devices and gears would be required.

With some backing of understanding of the processing problem, Sperry received machine tool orders. Barber-Colman was the only vendor willing to attempt to meet the requirements.

The result was a new kind of precision gear lathe, mounted on a granite concrete block, to machine it from the rest of the building. The first stainless-steel gears have been cut at Sperry and although they don't quite make the tolerance, there is every indication that those with manufacturing difficulties will be cleared up.

Some Problems

Material hardness is one area where improvement in control of the supplied block is necessary. Steel supplies indicate that they may be able to furnish a finished stock of a guaranteed hardness, with a much homogeneous composition.

Grinding of the block to fit a smaller problem. It is too time-consuming. There is a real need for a fast service accuracy to about one-thirtieth.

High cleaning is another standing block. Cutting fluid and oil blast don't complete the job. A soft brush will leave enough of a deposit to chip the accuracy. A hard brush will scratch the tooth surface.

De-burring is a third problem. Burring is cut and mechanical means are too inaccurate. One possibility: An electrical-discharge deburrer, using a tool which never touches the work.

Reynolds Metals Delivers First Titanium Extrusions

Reynolds Metals Co. has delivered its first commercial order of titanium extrusions to a jet engine manufacturer. The company's first fabrication of titanium was the result of two years of research in Reynolds' laboratories.



Provision cold drawing tubing is a science with TMI. It is a combination of trained brain power and production facilities developed to match the design demands of client manufacturers. From guided mandrels to benton machines, we make you to function pipe — our results are the same. Better tubing by TMI pays a big part in building a better future.

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CRUISING ON TOP, model shows lines in new white hull paint of entry more than (forward), and hydrofoils (aft).



EXHAUST TRAILS in successor to model that crashed Dec. 7 take off from Chesapeake Bay for 1 hr. 25 min. flight.

Second XP6M-1 SeaMaster Begins Tests

With Same Configuration, Different Colors



1. SECOND MODEL, in test tests, cost 2 to 3 ft. more, but rode easily as first model did when this picture was made.



2. NOSE OF FIRST MODEL cuts in airplane is fitted as "step." Test boats on coast does not appear in picture of new photo.



3. SPRAY LESSONS in hull of the first SeaMaster beats water. This model of 600 mph. multi-jet 3 engine color, not two tone.



4. AEROSOL, first model does not display lines for hydrofoils, and the water rubles in boats, or water does.

GE Bids for Helicopter Market With T58

By Robert H. Cushman

The T58 engine is General Electric's entry in the growing helicopter powerplant market. The 1,600 hp gas-turbine is scheduled to finish qualification tests and undergo field and flight tests in the Sikorsky S-55 in the near future.

Although the T58 has been financed by the Navy, GE hopes to expand its sales beyond military helicopters. The company is studying the T58 in various modified variants for turboprops and jet aircraft.

The small shaft turbine is the result of GE's Small Engine Department, Little Rock, Miss., attempt to come up with a gas-turbine which would be:

- **More** better for helicopters than present piston engines
- **Attractive** to helicopter designers and operators in competition with other engine manufacturers' new designs.

GE claims that to be better for helicopters than a reciprocating engine, its gas turbine must equate in its theoretical ability to increase a helicopter's performance through more power for less weight and size. At the same time the actual hardware product must not be too susceptible to its own weaknesses, high fuel consumption, and a sketchy use-type of transmission.

A Lightweight Engine

GE designers have attacked the fuel consumption clutch by choosing a moderately high compression ratio. Then, to retain low reliability and low life, they looked away and chose a moderate turbine inlet temperature. Among these two power design decisions the Small Engine Department has produced a remarkably lightweight engine.

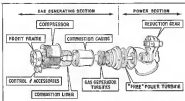
The T58 not only cashes in on the scale effect inherent in small size (a engine gets smaller, engine design off target the smaller) but GE designers have given it the benefit of what Hanki Dickinson, project manager, calls "moderated design sophistication."

The resulting lower engine, low reduction gearing, combined a 59 sec with a specific weight of 24 lb per hp. It satisfies a power engine's size in major area of helicopter application. But it remains to be seen how much more it will cost. The T58 will still be a cheap engine.

The T58 uses a free turbine or gas connected geartrain, between its gas generating section and the output shaft. The free turbine fixed to its end of the compressor shaft develops only enough power to turn the compressor.



T58 TURBOSHAFT engine pulls more than 1,600 hp into a 35 in., 525 lb frame. Specific fuel consumption is 0.65 at sea level rating.



SCHEMATIC shows flow arrangement of components in T58. Suction fuel nozzles (1 on each of two assemblies) are mounted on front of combustor's lower lines.

Downstream is a third, free turbine on its own shaft which absorbs the left but low fuel compression the gas turbine must operate to retain the speed fall-off and speed up the gas generating section. Since the gas generator's rpm is independent of the output rpm, the compressor turbine of the gas generator can more readily respond to the increased fuel flow and send more gas energy back to the power turbine.

Advocates of free turbine say the fixed turbine drive under these worst conditions will find no efforts to respond to corrective control and extra power severely curtailed because it is added with the adverse effects of the helicopter's noise.

Constant Rotor Speed

Helicopter operation demands constant rotor speed despite sudden loads. For example, when the pilot suddenly has to increase the rotor pitch to climb, the rotor will not fall off and still the blades. Backers of the free turbine drive point out that if the free turbine's rpm is unaltered down by the rotor, the free turbine will take in the pull more power out of the gas.

This inverse relationship between

free turbine speed and power for a constant gas energy is so self-stabilizing, but low fuel compression the gas turbine must operate to retain the speed fall-off and speed up the gas generating section. Since the gas generator's rpm is independent of the output rpm, the compressor turbine of the gas generator can more readily respond to the increased fuel flow and send more gas energy back to the power turbine.

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Not Unanimous

As yet the helicopter industry is not unified with free turbine drive. The free turbine drive helicopter, the fixed turbine is superior, argues Ralph Alex, senior product design engineer,

New Technique makes possible

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This new weapons concept is the re-

sult of Navy's new catapult capability, a launching unit developed by Chance Vought and the remarkable reliability of Regulus, first operational attack missile to serve with the fleet.

The ever-increasing versatility of Regulus is another demonstration of Vought's tradition of engineering excellence...a tradition that will continue to create bold new weapons as long as the need for them exists.

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DESIGNER AND BUILDER OF HIGH PERFORMANCE MILITARY AIRCRAFT SINCE 1917



At Today's Supersonic Speeds—"skin friction" causes blistering temperatures to build up within jet aircraft. Here's what Goodyear is doing about

the problem of Hades in the Heavens

It's smacking the second barrier, stream and atmospheric engineers have encountered yet another: *The Heat Barrier.*

Today it represents the most formidable foe of aviation progress.

For at blistering speeds, blistering temperatures build up.

It is the result of "skin friction"—caused by the rush of air rubbing against an aircraft as it slices its way through the sky at speeds twice that of sound, 2,500 miles per hour and faster.

Goodyear is devoting extensive research to high-temperature problems and high-temperature materials.

For within the high-speed aircraft of tomorrow, if they are to achieve their estimated speeds—temperatures will soar to 500°F. and beyond.

Under such heats, present aircraft structural materials tend to disintegrate—to lose strength at an alarming rate, become totally inadequate.

In this research, Goodyear is notably well equipped.

It has processed new alloys, new materials for aircraft wheels and brakes—a place where high temperatures have long been a major engineering hurdle.

It has discovered ways of building in "heat sinks" to store heat until it can be dissipated—and applied by the recent development of the Tri-Metallic aircraft brake

It has developed, for guided missiles, new inorganic compounds—materials which withstand devastating heats, yet have many of the desired qualities of existing organic materials.

It has explored the realm of new "synthetic" elements, experimented with fluorinated additives, silicones and polymer coatings—studied their performance on the "Rex of Fire and Destruction."

Today, this high-temperature research for Goodyear's Aviation Products Division continues—with the full backing of Goodyear resources, facilities and skill.

Many of these problems are far from solved, but progress is being made—progress which will be helpful to the aircraft industry in keeping America first in the air. Goodyear, Aviation Products Division, Akron 16, Ohio, and Los Angeles 51, California.

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Sikorski, as shown in his views (AW Feb. 22, 1954, p. 22). Because the fuel turbine is lighter and can quickly meet sudden rotor speed variation with the added inertia of the compressor, it really is better equipped to supply the power constant velocity required in modern high speed helicopters.

The free turbine is used to best advantage, Adco says, in multi-engined helicopters which might want to lower rotor speed at low power for considerable lengths of time. Because the internal gas generating sections of multi-engined installations are not rigidly geared into the common rotor this can adjust their operating speeds to equally divide up the workload.

A free turbine can operate at cheaper fuel consumption during part power demand.

In compressor can slow down to its own speed. It can, in effect, become a smaller engine cutting down the flow through the compressor to meet the lower demand. Even though the power demand on a fuel turbine is cut down, the compressor will still be maintained at the given helicopter rotor speed. It cannot slow down to match the reduced fuel flow.

Engine Details

As can be seen in the accompanying illustrations, the T35 is composed of a gas generating section followed by a power turbine in which the free power turbine takes the gas energy and converts it into shaft horsepower at 24,000 rpm. This is geared down to 240 rpm in the S35 in two steps: 5:1 by GE at the rear of the engine, and the

rest by Sikorski in the transmission.

The gas generating section has the usual gas turbine sequence, a compressor, a combustor and a compressor drive turbine. The power section is a single stage turbine. Downstream of the power turbine the spent gases are dumped out the large fixed rear exhaust which has been moved to rear side to give the designer extra freedom in installation. Obviously, as a helicopter approaches the cyclic speed is too low for efficient use of any jet thrust.

The greater part of the development work went into the compressor. GE says it is very advanced—it would have to be to achieve the stated rotor performance to weight. All that has been officially said about the compressor's internal details is that recent NACA compressor researches suggest that have been followed to achieve the modestly high compression ratio within a modest number of highly loaded stages. Otherwise the internal details are under tight security wraps.

The external appearance indicates a small diameter (slightly over 9 in. as quoted by Helman), about as eight stage unit. Along with the Napier Drive it must be one of the smallest pure multi-flow compressors in aviation. In fact, because of the harmful Reynolds number effect on the small blades of such compressors (the last stage blades of the Gyra 12 stage-6:1 compressor ratio are only 1 in. high) many designers say it is impossible to make an axial flow compressor any smaller.

The four stage forward the front



Changes in RAF's Vulcan

Area Vulcan are going into RAF squadrons shortly this year. Leading edge extension on the latest production model virtually doubles maximum critical speed and presumably keeps lips from stalling. Area of vortex generators has been added to upper wing surface. Vulcan is equipped with four Bristol Olympus engines.

A tooling problem?



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Electronics Division, Dept. AW-64

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McDonnell Locates Tools By Radioactivity

Removal of such locking bars and other small tools from aircraft prior to flight is being insured at McDonnell Aircraft by embedding a small radio active source in the body of each tool so it can be located by a scintillation counter during preflight inspection.

The McDonnell quality control department inspects each activated tool to see that the proper amount of shielding is provided for the protection of employees. The maximum dose to which workers are subjected as well within the tolerance limits established by the Atomic Energy Commission. Instruments provide continuous radiation data and some recent studies point to the fact more radiation than the limited tool.

Consists 137 Advantages

Consists 137 was the safety choice for the radioactive source because of the following factors:

- No adverse change in radiation output occurs during the average life of the tool.
- Gamma rays given off are strong enough so that minor obstructions between the source and the detector do not seriously limit detectability.
- Consists 137 is available in convenient form and at reasonable cost.
- Scintillation counter for gamma rays of this energy have a high detection efficiency thus allowing minimal amounts of radioactivity to be used.

The radioactive source is made up as a standard plant and is hermetically sealed in porcelain before being brought to the McDonnell plant. Should a tool fracture, the container can be easily located and disposed of without concern contamination of the surroundings.

The sources are loaded into tools by radiological physicists supplied by Nuclear Consultants Inc. Tools containing sources are indelibly marked to allow easy identification.

Tools radiate that 100% accurate can be ascertained on tools left in place at an stage of completion.

Authorities for procurement of the instruments had to be secured from the Atomic Energy Commission.

Caltech Specifies Mach 9 Tunnel

A \$750,000 contract to build, install, and test the design of the air duct, hot section and diffuser for a 25 inch hypersonic wind tunnel at the Jet Propulsion Laboratory of the California Institute of Technology has been awarded to Westinghouse Electric Corp. The contract will let by Army Ord-

today's most stable voltage control device

silicon function zener reference elements



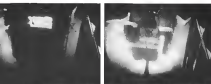
Model	100V	150V	200V	250V	300V	350V	400V	450V	500V	550V	600V	650V	700V	750V	800V	850V	900V	950V	1000V
POWER (WATT)	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
POWER (WATT)	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
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national

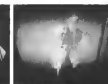
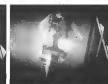
electronics

For voltage control device yet developed compares with the better service and extreme accuracy of rugged Integral Semiconductor Silicon Junction Zener Reference Diodes and Elements. Precision built to withstand severe shock, vibration, moisture, humidity and altitude conditions, these elements only have a temperature coefficient as low as $\pm 0.01\%$ per $^{\circ}\text{C}$ —operate predictably and reliably from -65°C to $+200^{\circ}\text{C}$. Today, MS Zeners give trouble free service in analog computers, modems, power supplies and scores of other applications requiring critical voltage regulation over a wide temperature range. Dependable MS Zeners may be the answer to your critical voltage regulation needs. See White Paper for complete details.

Microelectronics Corporation, 115 First Avenue, Evanston, Illinois



CAMERA, on sled from in Hercules sled, 400 ft. run, shows bottom of seat (left), wing (center), and legs of dummy as seat falls.



SIGNIFICANT SEQUENCE shows dummy gradually beginning forward tumble. Dummy is chest down in Vapour at right.



FROM FRONT POSITION dummy turns head-down. Pictures were made at rate of 500 per second on 680 mph sled.

DUMMY DISAPPEARS AFT. Time elapsed was less than picture in about 1/10th of a sec.

Camera Catches 1,000 Pictures Per

By George L. Chasman

New York—A new series of high speed motion picture cameras capable of 12 to 5,000 pictures per second has been developed by Fairchild Camera and Instrument Corp.

Douglas John H. Waddell told Aviators 'What the camera called the Fairchild Motion Picture Camera (MPC) were developed for other uses besides the military.

"In designing the unit," Waddell said, "research engineers tried to strip the MIL spec. use MAC units are in use now that they contain the speed a change in the state of the high speed motion picture art."

Light and Rugged

The camera and their associated equipment such as 24 in. power packs and special, 160 watt lamps, are small and light enough to be truly portable. The camera alone weigh from 9 to 11 lb depending on the model. Waddell said the camera were built with a "hardcore concept" is used to provide

an easily portable high speed photo lab.

The MAC camera, which can 16 mm film at 500 to 100 ft. rolls are available in two basic models, each of which has several variations. (Rear models, using a newly developed film, will have 40 ft. capacity.)

Two Models

The two models currently available are:

- **HS100**, airborne unit, 4 in. wide, has a pic. (pictures per second) speed range of 100 to 1,000, and weighs 11 lb.
- **HS100**, industrial unit, 7 in. wide, has a pic. range of 12 to 500, and adds weight, weighs 9 lb., 2 lb. less than the airborne version.

First production models of the MAC camera already have been exhibited. They will look a lot like the 1,700 mph. sled on a supersonic sled at the Naval Ordnance Training Station (NOTS) in San Jose, Calif. The camera has been tested perfectly despite initial acceleration loads of 300G, and continues vibration loads of 50G which

were strong enough to loosen some of the lenses.

The color film model of the supersonic sled was shown to the press. Some experience. The color unit height and

quite robust. The 1,000 pps. Maxing rate slowed the 1,000 mph sled to the pace of a launch. Similar afternoon auto ride, the extreme roughness of the ride and severe jarring of the camera was easily translated to the scene.

Dummy Blast

Other MAC camera have been used successfully to photograph a 600-mph sled not doing much in an Indianapolis class down a blast sled in an explosion test.

One camera being backward, side on its base of the module-propelled sled firing the explosion sequence at close range. It was subjected to 60G deceleration forces.

A second MAC camera, stationed near the sled track, recorded the run from the ground.

Second On Supersonic Sled

Both cameras operated at a rate of 800 pps.

Here are some other aviation applications Fairchild officials see for these high speed cameras:

- **Maneuvering and flight phenomena** in aviation.
- **Vibration detection** in helicopter blades, a MAC camera is already at work on such a project. It is attached to one of the blades and takes high speed motion pictures of the hub and rotor assembly by one of the camera's leading helicopter manufacturers.

- **Release of bombs and other ordnance** or externally mounted items.
- **Acceleration and deceleration effects** on flight crew members and aircraft equipment, such as that experienced during catapult takeoffs and arrested landings.

- **Wire laying from aircraft** to determine best equipment and procedure.
- **Propeller vibration/stress studies** on multi-engine aircraft. (A demonstration film of a DC-6 propeller showed clearly that the prop on engine number 3, 2 and 1 were well synchronized but num-

ber 4 was turning appreciably faster than the others.)

Still other possibilities include: high speed landing and takeoff, effects of high speed and hard landings on tires and landing gear struts, jet engine air structure tests, aerial spray studies, and structural vibration investigations.

New motion may see the great from studying heat transfer activity during operations in the close proximity to trailing high speed engine packaging.

Inside the Case

Inside the MAC camera's heat-treated, cast aluminum alloy case, Fairchild technicians engineered the lightest possible drive motor and drive mechanism compatible with their rugged construction.

Example of the efficiency of the components used in the MAC camera is the 14 hp, short duty cycle electric drive motor which can accelerate the film from standstill to 1,000 pps. almost instantaneously. With the help of a second motor, the film can be stopped through the industrial veno-

of the camera at 5,000 pps. which gives it a speed past the limit of 125 ft. sec. or about 30 mph. Exposure is 1/75,000th of a second.

In operation, film is wound off the supply spool over a free-running sprocket wheel which feeds it past the lens and a rotating prism to the perforated take-up spool.

Prismless prism drive gears means much better projection picture: distortion less than that obtainable with turret-mounted cameras, and resolution is equal to or better than the best turret picture photography produced by other turret cameras, according to Fairchild spokesmen.

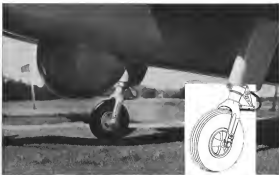
Rare Element Prism

The camera's prismless, rotating prism "swings" across light on the camera's rotating film as it is fed over the sprocket wheel.

Have a low F-number requires de-

scribe it. "The rotating prism has been selected for the highest possible index of refraction and the lowest dispersion rate with a minimum thickness and a minimum angle of incidence. The result is a finely illuminated picture that has a sharp focus line, with no

Golf course fairway — Seamew runway



Seamew — a tough, economical, all-weather amphibious biplane. In adverse weather — submarine weather — the Seamew can be airborne after a short take-off from an emergency strip... can conduct a radar search and low-level attack... and can land back safely almost anywhere (even on a golf course!) — due to its slow approach speed, and shock-resistant undercarriage.

The **Short** answer
is the **Seamew**



Efficiency of manufacture is facilitated by economy of maintenance, in detail of machinery and spare components.



Whether on soft or rough ground, and in gales, the Seamew can alight in an extremely small area despite its top landing speed and long take-off run. Type signs can be easily changed in real time.



The extremely good landing characteristics of the Seamew combined with simplicity of construction and their easy make it an excellent aircraft in its own right for pilots with little experience of this type.

overlapping of images from the one frame in the next.

Since the introduction of high speed color film, glasses of higher in doors of transducers could not be used because they have color gradually yellow. Therefore, a matt clear glass was selected for the pane which is a nearly 'water white' in possible and still has a high index of refraction and a low dispersion. Then, the image produced is free from color fringing, and color photography is possible without the use of color correction filters.

The rotating prism shift of the MAC camera is so constructed that the camera will operate at 51°C without causing optical distortion or malfunctions. Picture tests of live subjects indicate a resolution which is not at all possible to make single frame enlargements from the original film.

There are some other features of the MAC camera:

- An adjustable bracket on the foot pedal can be set to prevent camera when the camera is stopped and started during high speed runs.
- The camera will operate at temperatures ranging from -64°F to $+200^{\circ}\text{F}$.
- Four motor setups are available for the MAC camera, and the motor can be interchanged within a minute.
- The submarine camera, which measures 11 x 44 x 4 in. is provided with a 13 mm. f 11 lens with lowest weight! Other interchangeable lenses range from 15 mm. f15 mm. Camera price is \$1,175.
- The industrial camera, which measures 7 x 54 x 35 in., normally is provided with a 75 mm. f 1.9 lens. It also will accommodate lenses ranging from 15 mm. f15 mm. This camera accommodates two AN-type cameras—one for power, the other for a timing light. Price is \$1,190.

Mid-Air Refueling Saves Navy Fighters

Mid-air refueling in the neck of time recently saved two Navy fighters from Dow Jones' Locker.

In one instance an F-101 Bomber scheduled to rendezvous with a tanker lost radio and radar contact and failed to show at the appointed refueling station over the Mediterranean. After a search the fighter was located. With 24 men of fuel remaining a North American AJ tankster refueled the F-101 and it returned safely to its base.

In another case the pilot of a Grumman F-9F found he could not land immediately because of a "hooked" carrier deck. He was forced with ditching when refueled by an AJ tankster and was able to remain aloft until the deck was cleared.

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Range: 0.5 to 9-2000 psi
Types: Absolute and differential.
Viscosity: Ambient 0 to 25 cps, 0 to 500 cps, and solvent viscosity 10 to 5000 cps.
Construction: Statically sealed.
Wicks for Pressure Operated Potentiometer Indicators



ULTRA-SENSITIVE PRESSURE SYSTEM

Output: 50 mV on full scale.
Range: 0 to 10 psi, differential.
Resolutions: 1 x 10⁻⁴ psi.
Zero stability: Better than 1 x 10⁻⁴ psi.

Write for Bulletin 1702



RESISTANCE BRIDGE PRESSURE PICKUP

Sensitivity: 5 mV/psi on full scale.
Range: 0 to 10 to 1500 psi.
Types: Absolute and differential.
Construction: Hermetically sealed.

Write for Bulletin No. 7



RATE OF TURN

Output: 5 volt signal on full scale indicator.
Range: $\pm 15,000^{\circ}/\text{sec}$.
Type: Precision 98 sec. at sea level to 2 sec. at 10,000 ft.

Write for Vertical Speed Potentiometer Bulletin



RESISTANCE THERMOMETER

Resolutions: 5 to 500 ohms at 32°F.
Accuracy: Finest or sealed.
Range: -200 to $+2000^{\circ}\text{F}$.
Types: Lead, profile, pin.
Construction: Customized special, various vehicle systems, fast speed of response.

Write for Resistance Thermometers Bulletin

"T" or Transducers See Trans-Sonics"

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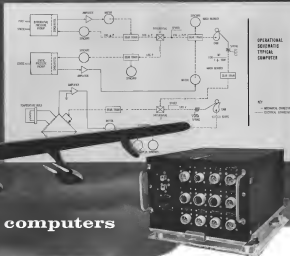
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Aeronautical
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...perform functions virtually unlimited in scope

Kollsman electromechanical computers are being used in autopilots; photographic, bombing and fire control systems; navigation equipment—some in conjunction with radar. Scope of design is almost unlimited.

The key elements of the Kollsman Air Data Computer System are the Synchrostat Transmitters and the Pressure Monitors, using displacement type diaphragms, to provide the necessary inputs. These Kollsman units have had their reliability proven again and again by the thousands now in use. And, there is more than 38 years of unique experience behind the development and perfection of the displacement type diaphragm by Kollsman. That's why you can expect superb performance and accuracy characteristics in a Kollsman Computer.



...now available in systems such as the following:

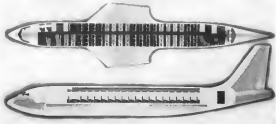
Air Data Ground Position (GPR)	Master Air Data Static Pressure Converting	Temperature and Humidity True Airspeed and Mach Number, CDR
The subjects of such computers, having accuracies better than 5% of range, are specified functions of the following:		
True Angle of Attack Absolute Pressure Indicated Airspeed	Equivalent Airspeed True Airspeed Mach Number	Indicated Air Density True Air Density True Temperature

We're for illustrated literature with complete technical data.



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SEATING arrangements in cabin allow quick conversion from four to five to six abreast. Much of cabin interior is plastic.

Boeing Shows Luxurious 707 Interior

New York-In a cool, lofty room on the eighth floor of a building on Manhattan's First St., an experiential in sales techniques is being given that may well be a harbinger for many air-craft manufacturers operating in this highly-competitive jet age. It is a show being put on by the Boeing Aircraft Co., a licensee, complete mockup of an interior of the company's new 707 Jet.

The cabin mockup, which has been standing since last November, is breathtaking in its detail and in the luxurious colors which abound—red, blue, pink, glacier blue, orange and gold grey.

And the list of those rich and powerful customers who have viewed the exhibit to date can be taken as an example of its effects even. Among them have been:

- American Airlines—C. R. Smith, president; G. M. Moore, vice president; C. R. Spren, vice president; G. J. Brandenbuck, vice president for passenger and service; R. E. B. Donahoe, vice president for customer service; M. Whelock, vice president for maintenance and engineering; W. Littlewood, vice president for equipment research.
- Braniff—Charles E. Board, president; J. Jackson, vice president; C. G. Allen, vice president.
- Continental—Robert F. Ser, president.

C. H. Coffman, vice president for engineering and maintenance; Harold L. Lawrence, vice president for traffic and sales; Matt Kuntze, territory sales manager.

- TWA—John A. Collins, executive vice president, and a working group of 21 people.
- Air France—Louis Lemon, president; H. J. Leconte, general manager; Pierre Franklin, operations manager.
- Sabena—D. L. du Vivier, general manager.
- Lufthansa—Eberhard Jacob, open team manager.

During the first few days of the mockup's operation approximately 150 air line and aircraft industry executives

and employees inspected the cabin being reported twice that number to go through it within the month.

"Airline VIPs have been uniformly enthusiastic," a Boeing spokesman said. "This reaction definitely is that the mockup is proving a very useful selling tool both for those already signed for 707s and those still in the prospect class."

The Tugue organization's philosophy of design in airline craft is to eliminate the "trunk back" (AW May 14 p. 92). But even so, Tugue does not believe in busy curtains on windows or other bulk. Special plastic slides either eliminate glass at black out the windows entirely. Most of the cabin interior—walls, ceiling and luggage racks—are made of plastic or plastic laminated on wood. The cabin also is given a spacious feeling by the large number of windows, about twice the number usually found on transport aircraft.

Other Features

Other features of the half-million dollar installation:

- Loud speaker whistles on aerial—but very limited—operation in the prototype 707's jet engine room.
- Daylight-type illumination outside the front cabin windows permits greatly from the full glare of daytime light at 40,000 ft. to the appearance of a moon low night.
- Individual speakers at each half-row of seats have the clarity of hi-fi organ chorists.
- Down lights along the ceiling can be dimmed to match red light in darkness to sleep, night blue with halolight stars. The blue illumination can be left on at maximum light for night flight.

The cabin is virtually complete. The cabin's first holding service operator as they would in the production airplane. Water runs in the two galley and four lavatories, for condition-

ing keeps the cabin at pleasant temperatures. The pilots on equipped with electric seats, but not toilet, prohibition controlled liquid disposal and refrigeration.

The two passenger entrance doors are replicas of actual plane doors as are the two galley access doors. Life rafts are stored in ceiling racks and emergency evacuation slides are packed in floorboard closets.

Removable Panels

Other standard features of the Tugue interior are easily removable, perforated wall and ceiling panels. Passenger service seats are along from the bottom of the luggage rack instead of being installed on the cabin underlaid. The perforated, plastic or plastic laminated-on-metal panels are quickly and easily removed to permit inspection or repair of the aircraft's structure. In addition they are dirt resistant and easy to clean.

In making the passenger service items of cabin walls and ceilinging these into one piece per half-row of seats, Tugue has greatly increased the flexibility of the 707's interior. The panels are mounted on tracks, so are the seats, so that each panel can be placed in an almost position above the seat it serves, regardless of seat spacing. The distance between seat centers may be altered.

Combined in the pylons are small no smoking and fasten seat belt signs, a loud speaker for the public address system, and individual emergency egress routes, reading lights, ventilation and other attached rail features.

By using fully convertible seats, great



SEAL cabin doors, are hinged from inside.



FULLY convertible seats allow great flexibility.



CABIN has two forward heavy hangers. Bulkheads separating hangers from cabin may be moved for additional seats.

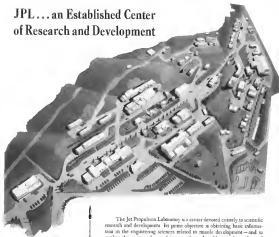


PYLONS have small no smoking and fasten seat belt signs, loud speaker for public address system, and individual emergency egress routes, reading lights, ventilation and other features for attachment.



FIVE SEAT abreast arrangement. Main cabin has 55 seats upholstered in different colors.

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The Jet Propulsion Laboratory is a center devoted entirely to scientific research and development. Its prime objective is obtaining basic information in the engineering sciences related to missile development—and to explore the various phases of jet propulsion. In addition a large share of its program is devoted to fundamental research in practically all of the physical sciences.

The Laboratory extends over more than 80 acres in the foothills of the San Gabriel mountains north of Pasadena. It is staffed entirely by personnel employed by the California Institute of Technology and conducts in many projects under contracts with the U. S. Government.

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flexibility in solving straightforward men be made, allowing space, convenience from floor to floor to subdivide rooms.

The colon is provided with two sets of double seat tracks, each cup-shaped from the colon wall. If double seats are used, the side seat is attached to the track, and the window seat is cantilevered from it.

There is an attachment between window seat and colon wall.

The main colon has 50 seats which are upholstered in alternating groups of blue-and-white and red-and-white fabrics in windows variety into the exterior and measure the length of the colon.

Adjacent to the aft entrance are two additional lavatories, another five-seat lounge and a second galley. (Blackboard spanning forward and rear bays may be quickly removed and two additional seats added).

The forward galley demonstrates the type of equipment required for transcontinental service, with present trays and containers. The aft galley is equipped to heat the kinds of pre-cooked and refrigerated meals that are served on trans-ocean flights.

Naval design and construction were under the direction of Frank Del Guadice, Seattle director for the Teague organization, working with Boeing engineers.

The Teague company, Boeing design consultants since 1945, spent 16,000 man hours on the working design and 25,000 man hours on its construction. Over 1,000 more man-hours went into the project.



Honeycomb Core Trim

Metal honeycomb trim is treated to not only shape and is actual used as the side on components (described) to achieve higher strength at lower L. Starting by a section which does the job quickly, more accurately and 50% cheaper. It consists of a table, a sheet, and an adjustable roller which is moved along tracks on the side of the table normally.

Ref. June 5, 1956 7

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...how to use the world's smallest, lightest ones

Write for our helpful free Brochure. Outlining the world's only complete line of microdot-type Core Drums, Cores, Tapes and Assemblies, including "Manuals." Costs to reduce and protect more 25%.

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Now!...the NEW ROBINSON WIRE TWISTER with DIAGONAL GRIP - HEAD



Former, more efficient than twist. The new, development DIAGONAL GRIP HEAD is designed especially for flame resistance. Made of tough glass, light-stroke, whirling, when safety-wire 20 times in time required for one by any other method. Costs as much as \$140 per machine assembled.

3-TOOLS-IN-1 performs various twillings, side-casting, oil-impregnated head. Pressured looms having 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 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WHAT'S NEW

New Publications

Structures in Aircraft and Shell Structures
—by Paul Kohn—Pub by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N.Y. \$14.00, 475 pp.

The book, an outgrowth of work done in the Structures Research Division of the National Advisory Committee for Aeronautics, is both a review for practicing engineers in the field of aircraft structures and a reference text for senior electric and graduate courses in the subject.

Proceedings of the Second Annual Computer Applications Symposium—Sponsored by Aeronautics Research Division of Illinois Institute of Technology—Available from Aeronautics Research Foundation, CARS, Technology Center, Chicago 36, Ill. \$5.00 per copy (covers the cost of printing, mailing, and handling).

Current applications of computers and data processing methods to basic and management problems as well as to engineering and research problems.

Proceedings from Fifth Annual Ohio Indiana Agricultural Aviation—Copies are available from the Ohio Aviation

Board, 501 Woodruffe Bldg., Columbus Ohio—(copies should be made payable to Ohio State University Agricultural Systems Conference Fund) \$2.50 per copy.

Summaries of talks presented at this conference which was held at Ohio State University on February 22, 23 & 24, 1956.

Safety Through Shop Graduate Aircraft
—by R. M. Woodhouse—Pub by The Daniel & Florence Guggenheim Aviation Safety Center at Cornell University, 405 Fourth Ave., New York 16, N.Y.

Copies are available at 75¢ each, or \$1.50 in combination with the 1955 Survey on "Safety Through Shop Graduate Aircraft" 41 pp.

Supplement to 1955 Survey covering shop and ground school problems of civil (VTOL) and short (STOL) take-off and landing types of aircraft.

Sources in Mechanics: A Collection of Abstracts of the present position of Research in some branches of Mechanics, written in Commemoration of the 70th Birthday of Geoffrey Ingram Taylor—Ed by G. K. Batchelor and R. M. Dorn—Pub by Cambridge University Press, Bentley House, N.W. 1, London and available through Cambridge University Press, 32 East 57th Street, New York 23, N.Y. \$9.50, 475 pp.

Group and Fracture of Metals at High Temperature—Proceedings of a Symposium held at the National Physical Laboratory, Hatfield, June 1954—Pub by Her Majesty's Stationery Office, London, and available in the U.S. from British Information Services, 20 Rockefeller Plaza, New York 20, N.Y.—\$5.00 (postpaid) 420 pp.

Contains 24 papers presented at a Symposium on the Group and Fracture of Metals at High Temperature which was held at the National Physical Laboratory, Teddington, Middlesex, England.

The papers are divided into four sections: deformation processes in new materials, creep occurrence of complex materials, theory of fracture, work on fracture creep and fracture.

Rail Back the Sky—by Wind Taylor—Pub by Bantam, Holt and Company, Inc., 185 Madison Ave., New York 17, N.Y. \$3.95, 181 pp.

Author tells about the B-29 news which flew the high-backbone Lockheed Constellation over Japan during World War II.

European Productivity Agency Technical Digest—Available in the U.S. from the Organization for European Economic Cooperation, Mission Publica-

tion Office, 2000 P Street, N.W., Washington 6, D.C. \$74.00 per year (12 issues), \$12.00 per six months (six issues), \$3.50 per single copy.

Digest of articles published in about a thousand European journals describing processes, methods, apparatus or materials which could be applied in industry to increase productivity. Included primarily for engineers and technologists, rather than scientific staff.

USAF Aircraft 1947-1956—by James G. Fisher—Published by Ships & Aircraft, Box 548, Falls Church, Va. \$2 pp. 31, 50.

An illustrated guide to U.S. Air Force and Army aircraft and missiles, detailing their procurement, characteristics and modifications. Covering the period U.S. Army Aircraft 1900-1946, the volume provides a key for searching through the mass of aircraft pictures since World War II, also a highly accurate and rapid recognition guide.

World Aircraft Recognition Manual—by C. H. Galloway and L. E. Bradford—Pub by John de Cuff, Inc., 51 East 10th St., New York 1 N.Y. \$3.75, 269 pp.

A new approach to aircraft recognition and identification, in which aircraft are arranged under the general headings of delta wing, sweptwing, straight wing and other wing (Publication date: Mar 18, 1956).

Introduction to Flight—by Art Phillips—Pub by The Ronald Press Co., 15 East 26th St., New York 10, N.Y. \$7.00, 229 pp., 278 illustrations, and 10 tables.

An introduction to the rapidly developing field of aerial flight for the advanced undergraduate and graduate student of engineering and for the practicing engineer.

Telling the Market

Photo catalogue of aircraft types of all periods includes, *Aeroplane Photo Directory*, Box 195, Toronto, Canada.

Guide of aerial photography, aerial photography and photogrammetry instruments and equipment. Catalogue 464, Gordon Enterprises 5902 North Colfax Ave., North Hollywood, Calif.

New material specifications for investment and capital, *Investment Crying Business*, 27 East Monroe St., Chicago 3, Ill.

Pinpoints of events and fact fighting for air aircraft charts. *National Air Photo Directory* Associates 60 Batterman St., Boston 10, Mass. Illustrated descriptions and specifications of aircraft models for aeronautics, testing facilities, facilities 1857 177, Flight Corp., High Bldg., Pittsburgh 22, Pa.

ENGINEERING TIMETABLE



1:50 P.M. HOLDING THE CURVES

The curves, of course, are not on the highway, but on the on/off-ramp. The new Fairchild Guided Missile Division engineers. The project today advanced equipment for a new FGM-109 project.

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Q. Letter from Daddy
A. Daddy

TO: KATE ROBERTSON

Dear Kate

No, I don't mind you flying around with that Montgomery Wardette from last year, providing you take certain precautions. Airplanes are safe but I just don't want to die. I see you're listed on the list of people who are "ladies" now, you better always wear a parachute. Keep this letter in your suitcase as a reminder. If word comes to hurt, make for the door like a wildcat, run, carry easily, and laugh.

I also insist that, if you're going to ride to it, keep your game to yourself by Southwest Airlines. Tell me that all old business pilots have found it's really less expensive and a lot more sensible to go First Class. After 36 years, SAC has the know-how and equipment to do flying's finest job of engine, maintenance, aircraft, cargo, instruments, navigation, and one-point distribution.

And SAC has Agreements! In the first half of '56 alone, 48 Southwest employees visited up 300 years of social service there. So other comparable people can make a statement like that about this airline:

No, honey, you're not experienced, even if you are 21, 184 lbs., 5'10", married and unemployed. So what? What? Montgomery Wardette!

Love, *Daddy*

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Valve Talk

FOR WM. F. WHITTAKER CO., LTD.
BY MARVIN MILES

The dog-eat-dog battle for engineers within the industry has reached alarming proportions, a battle fought against the background of a fixed engineering manpower pool.

Now does the vicious circle of pinning down the industry a bit of good. Sure, one company gains a small advantage when it hires a man as free from other concern, but it leaves a vacancy that can only be filled when the second company hires an engineer away from a third plant.

The basic problem—the crying need for more engineers—is now recognized but the industry is pursuing its old and new solutions with one eye level heavily on the advantage of growth of Russian industrial capability.

Studies have been made, appropriate training expanded, colleges and high schools revised, but the efforts so far have been industrial-specific and short-ranged—and the continuing, breath-takingly rapid pace of change in the "atomic" field is not being kept up by the "atomic" field.

Engineers everywhere who face the problem seriously deplore the present but declare that until the industry is a whole taken on the problem with a hard-hitting campaign, there's little else they can do.

"We have a fixed manpower pool in engineering," explains Ed Schuman, "Northrup's engineering vice president." "Those who cannot adjust to the changing pace of change balanced by those who leave it, but the problem is not in the present but in the future. It is not going to leave it and higher every day."

Schuman, and other talent-seeking executives like him, know well the growing advertising matter posed by them. They know the Soviet "take-and-keep" policy that forces down early young men to become engineers, entry of high-browed engineers into the service and down the drain for the future.

Gold statistics show the American peak output of engineering graduates came in 1916 (totalled at 10,000, by GI statistics) when 55,000 young men entered the field. Since then the figure has slipped to roughly 25,000 per year. On the other hand the Soviet graduate pool has jumped from 25,000 graduates in 1916 to 34,000 in 1953.

Some agree that although Russia has an able corps of technical experts second to none, the Soviet system is needed on a study engineers have in that the USSR suffers from not yet required that degree of "engineering thinking" which only breeds hampering

(Continued on page 17)

NEW AVIATION PRODUCTS

Noise Figure Indicator

Automotive noise figure indicator, Type 72, together with new Type 70 engine exhausts noise generator, continuously and directly indicate noise figure of a radio or audio receiver. This makes it possible to adjust or change receiver circuit, immediately note its effect on



performance. Noise generator comes in two models. Type 70A can be used as a "laboratory" over range of 200 to 2,500 mc.; Type 70B is mounted at a shallow angle through a waveguide, connects in several positions to cover band of 2,500 to 25,000 mc.

Authorize: Instrumental Laboratory, Inc., Mineola, L. I., N. Y.

Vacuum Cleaner for Jet

Boeing Aircraft Co. is using a specially built mobile vacuum cleaner to keep its flight decks and other areas clean of debris which might damage jet engines.

Called the JARC (Jet Aircraft Runway Cleaner), the truck-mounted unit develops design speed to 1,500 horse-hold type vacuum cleaners. The 16-ton machine has two 165-hp. gasoline engines which operate vacuum pumps connected by flexible tubing to nozzles. Material picked up falls into a separator, which can be emptied only by large doors.

U. S. Hoffman Machinery Corp., Syracuse, N. Y.

Small Pumps for Short Life

Miniatured oil-hydraulic pumps for limited life automatic applications can develop rates that are 100 percent per pound of total weight, when used in optimum stroke operating pressure and design maximum speed.

These applications include mobile hydraulic systems and for supplying emergency power in aircraft.

Typical of the new series is Model 9000, smallest of the line. It measures 2.5 in. long, 1 1/2 in. diameter and weighs less than one pound. With 15 deg. stroke angle, it is rated at 4-4 hp and 2.5 gpm flow at 12,000 rpm with a cushion operating pressure of 1,000 psi.

Victors, Inc., Box 382, Detroit 32, Mich.

Compound for Runway

Japanese party in concrete runway and on asphalt are being filled with a fat-soluble SCD-2 compound resistant to salt, grease, gasoline and jet fuel. SCD-2 is prepared by adding Chloroprene Latex to the latex salt in solution dispersal of rubber particles in tar.

Stadley Chemical Co., Elys, Ohio.

Oculiscope

Micro-Scope 103, condenser light projection, oculiscope with storage capacity, 70, which films and retains traces of electron patterns until deliberate erasure. This feature permits study of phenomena with duration as short as 1/10 microsecond. Storage is accomplished



by a mask immediately behind the viewing screen, which is changed by writing gun. Vertical amplifier sensitivity is 15 in. d.c., sweep speeds up to 100 seconds full scale are available.

Advanced Electronics Mfg. Corp., 2825 Pioneer Ave., Los Angeles 25.

Airport Scales

Auto and semi-trailers are provided a fast passenger luggage conveyor the first on service 600 scales.

Units come in lengths from 19 in. to 44 in. Platform is stainless steel. The scales are available with roller platform.

Fraser Scale & Manufacturing Co., 2716 W. 21 St., Chicago 8, Ill.

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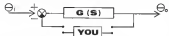
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valves independently controlled vacuum and hydraulic sources. The boiler can also heat, deaerate, and replace hydraulic systems, or can be used in shops for checking bleed drag instruments, hydraulic components and the like.

Different types of vacuum pumps can be attached to suit particular aircraft. A warning light is activated when the unit is in use.

Aerocomponents (Gasand Equipment), Ltd., Horley, Surrey, England

ALSO ON THE MARKET

"O" ring composed, 750-70, meets the requirements of high-temperature service in some military aircraft operating with MIL-G-5606 hydraulic fluid. It meets MIL-P-18817B(ASG) and its predecessor specifications. Temperature range of -65F to +275F has been established—Pneumatic Rubber Products Corp., Clinton, Ohio

High-flow shut-off valve features a non-ebullient straight-through flow. It can be used with liquid oxygen and fuels, high-pressure gas and hydraulic fluids. Self-cleaning seat arrangement provides a bubble tight seal under conditions of temperature from -158F to +356F. Available operating flow range is from 0.05 to one second—Hydramatics, Inc., Cedar Grove, N. J.

Wanda-Va water repellent is of varying viscosity for application on airplane windshields. A few drops virtually last several weeks—Wanda-Va Products Co., 1722 So. Staples St., Corpus Christi, Tex.

High-speed miniature relay is designed for discrete and low power applications. Operation is unaffected during shock of 50G and vibration (10-55 cps) of 10G. Temperature range -VTC is +100C; contact ratings up to 25 x 200 ma. Pull-in time (including bounce) is less than 100 microseconds; drop-out time 300 microseconds; static contact resistance less than 15 mho—Bosch Co., Watkney 23, Calif.

Both type valves absorb blast cleaning solution designed for removing sand, scale, rust, and other contaminants from any work that can withstand a tanking service. Operating load capacity is 25 to 40 lb. Unit can be operated automatically or manually—Whitlock Corp., Madison, Ind.

Diogen, a desiccant polymeric dust towel, offers high tensile strength, extreme abrasion resistance characteristics, long life, and resistance to high concentrations of acid and jet fuel, and



Minor seal used on Lockheed F-105 is made of silicone rubber to assure efficient, maintenance-free service at extremes of temperature. Silastic has proved ideal for sealing all types of aircraft engine openings.

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• Compression set, % @ 200 F	25 to 50
• Hardness (shore), Duremeter	20 to 80
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MERCY MISSION...

Kaman's HH-43 general utility helicopter, now in volume production, is designed to carry personnel, litter, medical or cargo internally. Fitted out as a "flying clinic" it can carry cargo along more easily. Equipped with a power hoist it can be used for search and rescue operations.

As a rescue vehicle the HH-43 got its baptism of fire in the disastrous Yarn England floods of August 1981, and came through admirably. Kaman is proud of these very missions. Kaman is a part of the past it is privileged to play in the continuing progress of National Defense.

KAMAN
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"IF WAR SHOULD COME,"

military officials have declared, "battles could be won or lost on the radar-scopes of our early-warning planes... and their mission would change from sentry duty to that of combat command post."

With such obvious technological advance in aerial warfare by potential aggressor nations, the maintenance of a sound-the clock radio-warning system becomes increasingly vital. That's why the USAF's RC-121D and the U. S. Navy's WV-2 Sentry Constellation are programmed and dispatched by large numbers day and night—their flight—have been flying day-night surveillance missions in all kinds of weather, around the globe.

Carrying 6 tons of radar gear, these Lockheed Sentry Constellations are programmed and are designed to provide 75-degree cabin comfort for a 33-man crew where outside weather is often 60. Powered by four Wright 3350-hp turbo-compound engines, these patrol patrol networks operate at altitudes over 25,000 feet, if necessary, and at speeds up to 400 mph.

Lockheed developed the various reflexes actually in the belly-midway. (From an altitude of 10,000 feet on RC-121D or WV-2 crew radarscan in an area of 45,000 square miles.)

Only 1 cockpit produces long-range early warning radar planes—a radar to the Sentry Constellation's second dependency and to Lockheed's leadership in long-range patrol aviation.

Lockheed

AIRCRAFT CORPORATION, BIRMINGHAM, CALIFORNIA
Look to Lockheed for Leadership



to radioactivity. Application for general use in laboratories and offices is available at prices from \$75 to \$300 g. New York International Airport, January 30, N. Y.

Elapsed time calculator is a device which takes time made up of a series of four numerical phase does (calculated or set from 5 to four inches). Then computer travel time, seven or an aid to navigation, calculates logged flight time of aircraft from and engines, and assists in flight crew scheduling.—George Loewer, Fox American Glass Agency, 135 E. 42 St., New York 17, N. Y.

Electronic, 5-wheeled clock can have two speeds forward with a maximum of 20 rpm, a rest or repeat automatic type indicator. Speed limit can be set and down to six miles per hour. Battery charger plugs into any 100-v a.c. outlet and automatic timer shuts off when charging cycle is completed. Maximum range approximately 36 mi between charges.—Electronic, Inc., 16254 Meyers Rd., Detroit 35, Mich.

Experimental alignment autoinstrument measures change in angle of arc to 0.00001 in accuracy. It detects small changes in angle through a total range of 35 sec. of arc. Unit can be reset as to line, side, or end to measure the alignment of eye, frame, or flat bed railings.—Bausch & Lomb Optical Co., 655 St. Paul St., Rochester, N. Y.

Step-function speed indicator combines versatility of a continuously variable speed drive with positive drive and exact repeatability of a geared unit. Also one of eight different speed ratios may be chosen without changing the speed drive shaft. Unit has torque capacity in excess of 30 in. lb. and is recommended for input speeds up to 500 rpm.—Hux Co., Division of Berry Controls, Inc., Galesburg, Mass.

Aluminum sheet cooler with 50 container capacity features a non-electrical mechanical safety locking device. Locking device has patented feature as designed that if temperature rises to —23 F. it is automatically locked, and a key is required for release. Unit is equipped with temperature control mounted in unit compartment having a range from 0 F. to —58 F. also, temperature indicator with built-in warning indicator thermometer with temperature range from +130 F. to —58 F.—Wichit Engineering Corp., Dept. ABC-364, P. O. Box 217, Indianapolis 6, Ind.

Model A4, workmeter of variable resistance type, is designed for light test applications. Unit allows measure-

ment on loads from 100 ohms to 1000 ohms, with resistance as high as 1000 ohms for 300 g. instrument. Model is available at prices from \$75 to \$300 g. Output is 40 mV. Input for full scale output and accuracy is better than 1 percent under normal ambient conditions.—North American Instruments, Inc., 2400 N. Lake Ave., Altadena, Calif.

Model 350A 10 sec. magnifying magnifying 100 times de to 500 KC. horizontal amplifier provides easy magnification of X1, X5, X10, X50, and X100. Full sweep range is .32 sec/cm to 15 sec/cm. Triggering may be internal,

external, or from line voltage on grid to a or negative level and slope.—Electron-Packard Co., 275 Page Mill Rd., Palo Alto, Calif.

Pressure-type seals, gaskets, and expansion joints are arranged to be threaded directly into any high-pressure pressure chamber. Units include 14 types ranging from 1/8 in. to 1 in. diameter thread size. Electrical lead is conveniently sealed through threaded case with a pressure-tight seal and having an modulus resistance in excess of 24,000 magnifying.—McConach Seal Assembly, 25 Hollister Airport, Hollister, Calif.



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Dutch Build Ram Jet Helicopter For Two

The Dutch expect to be delivering
production versions of this 2 passenger
ram jet helicopter early in 1957.
Netherlands Helicopter Industries
(NHI), Dordrecht, Holland, claims that
their 440 powered, 62 mph cruising
speed, 115 ft production model will cost
less than half of a conventional helicopter.
The prototype is fitted with two
55 hp ram jets developed by NHI. They
are designed to have household fan-
scoops, but also are capable of using
gasoline or jet fuels.

According to reports, the craft has
given mobile radio frequency character-
istics. Engine-out landings have been
accomplished without difficulty and
maneuverability has proven good.
NHI claims operational costs of the
aircraft will be half and maintenance
turnover rate is that there are no wear-
ing parts in the engine and no clutch or
heavy transmission.

Consequently, the best endurance is
under a half hour. One-hour flights may
be carried out for military observation
and liaison duties. NHI also is develop-
ing a winged version and a medium
helicopter for long range transportation
which is expected to be available this
year.

Supersonic Load, Heat Simulated in Tests

Full scale missile components are be-
ing tested under loads and temperatures
simulating those of high speed
flight at a new facility at McDonnell
Aircraft Corp.

A typical component as big as 15 ft
long and 3 ft diameter can be tested at
temperatures up to 1,000°F, smaller
ones can be subjected to as high as
1,500°F. Design loading rate is 157
psi per second.

The new facility uses a radiant heat-
ing system with quartz lamps and heat
reflectors. Flexibility of the installation
comes from moving the lamps with re-
spect to the specimen and from varying
the number of lamps.

Potential tests were run on the heat-
ing plant to check out equipment, its
mechanisms and operation. First run
was on a Titan missile wing and its
hull by McDonnell as part of the
overall Titan program sponsored by
Navy's Bureau of Ordnance.

Camera Spans Full Sky For Cloud Cover Study

A full day recording camera designed
for the Air Force Missile Test Center
is providing a detailed study of cloud
coverage and how it changes during a
day.

Information from the recording
camera is useful in studying basic data
on the atmospheric conditions for pho-
tographic and optical coverage of mis-
sile flights.

The camera was built by the Optical
Engineering Laboratory of Radio Corp.
of America, which operates the range
with the Van Aken World War
V. Heart of the unit is the Beebe
Vacuum tube camera which takes a
picture every 15 min through the lens.
The picture is of the full sky as re-
flected on the surface of a 12-in. glass
sphere.

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on completing the course and on award
of the master's degree. Courses are held
in the evening.

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Division is also producing transmissometer military equip-
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For airborne installations in particular, this miniaturization
design approach means greater reliability, longer life spans,
longer ranges, and deeper penetration for more positive
results.

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tions, navigation, marine guidance, and fire control...
frequently to accelerated delivery requirements. Facilities
for continuing progress in systems engineering and manu-
facture include over a third of a million sq ft of plant space
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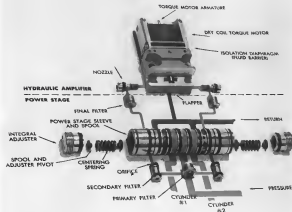
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ball lock action - front

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SOME OF EASTERN'S ADVANCED-DESIGN *Breakaway* COUPLINGS



for all aircraft and purposes. X-340 is the prototype type. Also, X-340 allows use of the automatic umbilical ground order between the U.S. for position being. It also has better ground support facility because of its square base.

First shown subject to the testing and developed by the airlines for their own use only. One of the most comprehensive facilities on this prototype is put out by United Air Lines as Meteorological Carrier 59. Flight Safety Foundation plans to get sufficient copies for distribution among its corporate members.

Points with X-340 equipment, involved in using the military ground because for position East can get the location of the vehicle in obtaining Bulletin BLD 510 from the U.S. Government Printing Office, Washington, D.C.

Cost is \$4 cents annually.

Positioning of the order scope in the cockpit is generally a difficult problem. The pilots were shown photos of Trans World Airlines' installation in the cockpit of its 10497 Super Constellation, a miniature scope mounted between the pilots. It folds into the door when not needed.

Approximately 110-115 airborne radar, mostly X-340 units, are now installed in corporate aircraft. They are certified with using the pilots' visual when flying in bad weather by showing pilots to avoid sufficient in advance to maintain distance, they also tend to have no ground connections times in bad weather.

Translaid Starts Ag-2 Dentier Franchising

A series franchise dealer/rep program has been started by Translaid Co., Vancouver, Calif., in basic sales of its new Ag-2 agricultural sprayer, which is to enter its first flight next month.

The low-wing, differential sprayer, powered by a 450-hp. I&W R605, is designed to carry a payload exceeding 2,000 lb. Ground loads can be either all dust or a 55-cu-ft. knock-top or 250-gal. of liquid in wing tanks, or combinations.

Two Ag-2s will be tested simultaneously to qualify for CAA Part 3 and other tests. The program is expected to speed certification and deliveries.

Surplus Northrop Trimotor To Fly Mexican Lumber

A former USAF surplus trimotor Northrop C-121B Raider transport will be used by a Mexican lumber mill operator to carry heavy loads to and from a 4,500-ft. elevated landing strip built at 8,500 ft. on a mountain.

Timber Y Malheur, Durango, will fly 10,000 lb. of lumber from the mill on each flight; the C-121B will load 14,000 lb. of materials, fuel and supplies on return legs. The flights will take 30 min., compared to aerial drops by surface transport.

The plane is one of 12 modified by five percent owner Frank Ambrose Aviation Co., Miami, Fla. Their 1,200-hp. Wright R1300-94 engines were replaced with 1,510-hp. R1520 56.



Pilotless Navions Test Remote Cameras

Remote-control aerial photographic and television surveillance equipment will be tested by U.S. Army Signal Corps using a drone system developed by Trans Aircraft Corp., Delko, based west of the company's office here, delivered to Ft. Monmouth, N.J., and Ft. Belvoir, Ariz. The project is built around an modified North American CL-77A Navion with 42-lb. remote control equipment operated by radio radio signals and 250-lb. ground control stations that can be transported in jeeps. Ground control involves point out-of-sight command of the Navion, updating programmed maneuvers.

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WATER RISES as Spring Vexer but also takes off from coast around at Alaska. Other

'Barrel' Tires Get Rough Field Test

Bird-shaped fin-owls will soon be used to operate at three-to-eight-passenger airports such as Airports are being tested by Goodwin's Aviation Products Division to increase the rough field capabilities of multi-passenger Cessnas (photo, right) the new 24-in.-wide Turb-Two with a standard 600-hp turboprop is used as a Stinson Voyager.

Already used by interactive vehicles, the new 'TerraTree' pliable sidewalk and low-pressure curbs let them to absorb or conform to uneven surfaces, lessening the danger of sudden crashes. Their wide tread is designed to glide over soft surfaces.



VARIABLES From panel managers as well as rough terrain are tested using Tom-Tom



HIGH-SPEED TAXI RUN over Indian. Victim is hospitalized, badly without records.

PRIVATE LINES

Use of a helicopter to attract attention to Wheelabrante Corp. dangles at Atlantic City boarder show recently suggests a way for rotary wing aircraft operators to put idle helicopters to work on charter during popular events in their locales. Bell 47 chartered by Wheelabrante had company's name painted on the side, used a temporary helipad on the beach and carried back-bucket holders over the city as guests arrived at Ford's display.

Albion Paper & Paper Co., Ltd., Toronto, Canada, acquired a DC-5 business plane from Raytheon-Walker, Inc., St. Louis. Selling 16 the plane has Reader's Digest number value.

Royal Gull appointments: Gull Aircraft Sales, Houston, Tex., and Marine Aircraft, Inc., Detroit, Mich., will handle sales of two-engine bombers and planes for Royal Aircraft Corp., Midway.

Land Arson, Inc., New York City, is a distributor for commercial Acropet-General 196S-1000 smokeless wrist tailed violet units. An increasing number of these are being installed on multi-engine business planes (AVW Nov. 25, 1975, p. 68) to increase safety in event engine fails on takeoff or to aid egress from small airports.

Aerwork (New Zealand) Ltd., Christ Church, Pigeon distributor, has taken delivery of 21 aircraft this far this year of all models. It has 14 more Pigeons on order, all PA-15 Super Cubs.

A 50,000-sq.-ft. aircraft shop, first major segment of Southwest Automotive Corp.'s \$2 million expansion, is operating at Love Field, Dallas, Tex.

A \$35 million contract for aerial mapping of 19 railway stations and tracks in British Columbia's southern and eastern regions has been granted Air Survey Co., Ltd., a subsidiary of Farny Aviation Co., Ltd. Railways plan to install new equipment and need accurate maps for efficient service.

Schwaiff's has entered the airport field with opening of a restaurant and bar at Westchester County Airport. Facility provides full meals to guests, also per-jet in-flight lunches.

Cleanup tip: Safe Flight Instrument Corp., reports that it has taken up to 40 lb. of dirt out of its DC 3 business plane during cleanup after each flight.



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A MESSAGE TO AMERICAN INDUSTRY • SECOND OF A SPECIAL SERIES

THE SHORTAGE OF SCIENTISTS AND ENGINEERS: Are We Losing the Race with Russia?

There is new confidence in the Kremlin. One key reason is expressed in a recent boast of Communist Party Secretary Khrushchev: "The capitalists always regard our people as being backward, but today we have more engineers and more supporting engineering technical personnel than any capitalist country." He promised that this lead would be widened and that communism would be victorious without war.

This boast cannot be dismissed as communist propaganda. Admiral Lewis L. Strauss, chairman of the U. S. Atomic Energy Commission, has warned: "In five years our lead in the training of scientists and engineers may be wiped out, and in ten years we could be hopelessly outstripped. Unless immediate steps are taken to correct it, a situation,

already dangerous, within less than a decade could become disastrous."

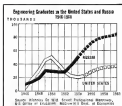
This second editorial in a series on the shortage of scientists and engineers is designed to explore as carefully as possible the facts and the implications of the new emphasis on technical training in the Soviet Union. It draws heavily from the authoritative book *Soviet Professional Manpower*, prepared for the National Academy of Sciences and the National Research Council by Nicholas DeWitt of the Russian Research Center of Harvard and released recently by the National Science Foundation.

Trend Is Against Us

If the Soviet Union already has a lead in technical manpower, it is not very great. Both the United States and Russia now have around a million scientists and engineers. About a third of the Russian engineers were trained on inferior pre-1935 standards. It's the trend—shown in the chart—that is alarming.

Over the last five years we have turned out only 142,000 engineers, compared to an estimated 216,000 in Russia. In 1955 our output was around 23,000 compared to their 63,000. Over the next five years our projected output is 153,000, against at least 400,000 in Russia. There will be an additional 150,000 or more in the satellites and Red China.

In Russia, 30% of the college students are in engineering, compared to 8% here. Another 30% or more take degrees in natural sciences. Moreover, unlike ourselves, the Russians are



RYAN AERONAUTICAL COMPANY

ploughing back a large proportion of their science graduates into teaching, which implies a rapid buildup in the future.

Quality As Well As Quantity

It would be foolhardy to assume that these new Russian graduates are inferior to ours in the quality of their technical training. They start out with much more intensive mathematical and scientific preparation at the high school level. They study harder and longer in college, with more laboratory work and more practical training. Their courses and textbooks seem to be as thorough as ours. Even though the Russian graduates may be overpersuaded, they get results.

These results have been striking. The Russians developed both *Admiral* and *Blackburn* faster than we expected, and it's not certain that they had to rely much on espionage. They pushed ahead of us for a while in jet fighter design, and they showed up with a fleet of long-range bombers well ahead of schedule. They are crowding us on nuclear power, electronics and automation. There are grave fears that they have established a lead in the vital field of military rockets.

The goal of Soviet scientific manpower policy includes not only weapon supremacy but also leadership of the neutral and unconfronted areas of Asia, Africa and the Middle East. The Soviet leaders may be bluffing in their offers to export capital, but they are preparing to export Russian scientific and technical know-how in a big way.

How They Do It

The Russians are determined to win the race for scientific supremacy, and they do not rest on the coast. They pay their scientists and engineers salaries that seem fantastic when compared with other Soviet incomes.

Senior professors, research scientists and top engineers are a major segment of the Russian elite. Their incomes are frequently six to ten times the average industrial wage. (In the U. S. six to ten times the average industrial wage would be \$25,000 to \$50,000 a year.) Housing and other privileges are correspondingly lavish. While preaching equality, the Soviets use capi-

talistic incentives far more boldly than we do. Indeed, practicing engineers and scientists have been complaining about the exalted status of professors and top research people, and salary scales are now being adjusted to give greater emphasis to practical results.

The Russians are also generous in their aids to education. Tuition has just been made free at all levels. Undergraduates receive 200 to 300 rubles a month and graduate students 800 rubles (about equal to an industrial wage) to cover living expenses. The biggest stipend goes to science and engineering students. College students are deferred from military service, and engineers and scientists often enjoy continued deferment even after graduation.

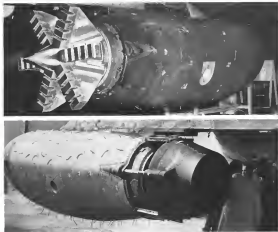
Finally, the Soviet leaders can channel engineers and scientists — and all other human and material resources — into any area they choose. And the areas the Soviet leaders choose are predominantly those that contribute to military or political objectives, rather than to a better life for consumers.

What's Our Answer?

We are certainly not going to adopt Soviet methods. We do not want scientific robots, but free men, able to understand and add to our democratic heritage. At the same time, our world leadership in technology — and perhaps even our survival as a nation — will be threatened if we allow ourselves to lag far behind Russia in the training of scientists and engineers. Ways to keep the United States at the pace will be discussed in a later editorial in this series.

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Donald C. McGraw
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Boeing engineers meet two pressing jet-age problems

More different kinds of Boeing engineers have worked together to develop the prototype sound suppressor (top) and thrust reverser (bottom), shown installed on the Boeing 707. On production 707 jet engines, however, the two will be combined into a single unit capable of performing the duties of both the suppressor and reverser. The results here serve as testimony that Boeing has one method to deliver 707's jet engines, beginning in late 1959, equipped with sound suppressor thrust reversers.

This is an example of the more important coordination Boeing engineers—mechanical, civil, electrical and structural, as well as specialists in physics, mathematics, acoustics and other fields—are making toward the progress of jet-age aviation.

This work is challenging and creative, at the very frontiers of engineering knowledge, on the B-52 jet bomber, the KC-135 tanker transport, the 707, the

BOEING B-57H weapon system, and on aircraft of the future. Boeing is an "engineered company," with more than 6,000 technical graduates employed.

Boeing now employs more than seven at many engineers at the peak of World War II. But, because of steady expansion, more research technical men are needed. They will work with superb facilities, including the multi-million dollar new Boeing Flight Test Center, the latest electronic data reduction equipment, and a new wind tunnel, which will be in operation shortly, capable of velocities up to Mach 4.

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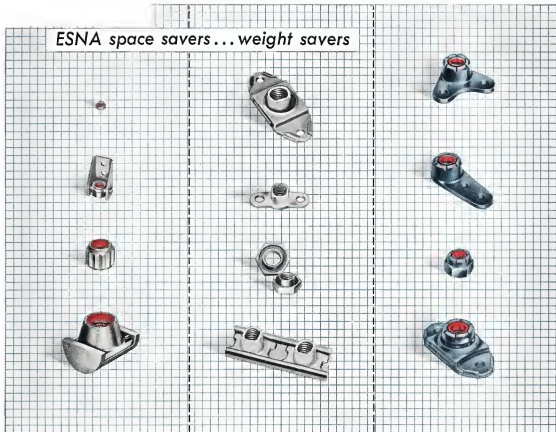
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